Technical Support Document
For
Proposed Regulation No. 1146
Electric Generating Unit (EGU) Multi-Pollutant Regulation

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Introduction

The proposed Electric Generating Unit (EGU) Multi-Pollutant Regulation is expected to help Delaware attain and maintain the National Ambient Air Quality Standards (NAAQS) for ozone and fine particulate matter ($PM_{2.5}$), assist in Delaware achieving the emissions reductions needed to support the state's 8-hour ozone Reasonable Further Progress Plan (RFP), reduce the amount of mercury emitted from Delaware's coal fired EGUs, reduce the amount of hydrochloric and hydrofluoric acid emissions from Delaware's coal fired EGUs, meet Delaware's obligation under the federal Clean Air Mercury Rule (CAMR), and to help meet Delaware's regional haze obligations. The regulation establishes new emissions limits for nitrogen oxides (NO_X), sulfur dioxide (SO_2), and mercury from Delaware's coal-fired EGUs with a nameplate rating of 25 MW or larger. The regulation also establishes emission limits for NO_X and SO_2 from residual oil-fired electric generating units with a nameplate rating of 25 MW or larger.

The proposed multi-pollutant regulation is not intended to replace the federal CAIR requirements and does not relieve affected sources from participating in and complying with all CAIR cap-and-trade program requirements. The proposed multi-pollutant regulation will, upon approval by the US EPA, provide requirements that will take the place of the federal CAMR program and, thus, affected sources would be prohibited from participating in the CAMR cap and trade program.

In early 2003, Delaware's Department of Natural Resources and Environmental Control (DNREC) began discussions with Delaware's large electric generating companies towards achieving significant reductions in power plant stack emissions. Those discussions included NO_X, SO_2, and mercury emissions reductions. It was DNREC's goal for this effort to evaluate a range of emissions reduction options, assess the feasibility of the options, and develop a voluntary implementation plan to implement feasible emissions reduction technologies. A number of meetings were held that included presentations by power plant owners and operators. Voluntary plans sufficient to meet Delaware's goals of achieving desired reductions were not developed by power plant owners and operators, and DNREC determined that the development of a multi-pollutant regulation was the appropriate method to achieve the desired emissions reductions.

DNREC began the development process for the proposed regulation with the November 2005 signing of Start Action Notice #2005-09 entitled "New multi-pollutant regulation applicable to Electric Utility Generating Units (EGUs)." DNREC established a review committee in January 2006 to aid in the development of the regulatory requirements and language. The committee consisted of representatives from DNREC, the public, environmental groups, and owners and operators of affected facilities. A series of committee meetings were held to share information and present the position of various groups and individuals. During this series of meetings presentations were given by DNREC, representatives of several environmental groups, representatives of various Delaware economic bodies, representatives of the owners and operators of the affected

facilities, representatives of labor groups, and representatives of power industry trade groups.

In order to make all of the information readily available to interested persons and the public, DNREC established an internet web page to post copies of presentations, links to related information, and comments received by DNREC regarding the multi-pollutant regulation. That web page may be found at: http://www.awm.delaware.gov/Info/Regs/AQMMultiPReg.htm.

While addressed in more detail in various sections of this document, the result was the development of a proposed regulation that is intended to achieve pollution emissions reductions sufficient to address the shortcomings of the federal Clean Air Interstate Rule (CAIR) and meet to Delaware's obligations under the Clean Air Mercury Rule (CAMR). The proposed multi-pollutant regulation does not adopt the federal CAIR program, but rather supplements the CAIR program by setting hard NO_X and SO_2 emissions caps that may not be exceeded for affected facilities. However, the establishment of these hard caps in the proposed multi-pollutant regulation does not prohibit participation in the cap and trade aspects of the CAIR program. Nor does the proposed multi-pollutant regulation set or establish NO_X or SO_2 CAIR allocations for any of the units subject to the proposed multi-pollutant regulation. These units are subject to all of the US EPA's CAIR requirements (including its allowance allocation and cap-and-trade provisions), independent of the proposed multi-pollutant regulation. Thus, the units subject to the multi-pollutant regulation must meet the requirements of the multi-pollutant regulation independent of any compliance provisions of the CAIR program.

The proposed multi-pollutant regulation also establishes hard mercury emissions mass caps for affected facilities that may not be exceeded. The mercury mass caps are similar to the caps that would be established under CAMR, but the affected facilities are prohibited from participating in the CAMR cap-and-trade program, because Delaware's proposed multi-pollutant regulation is intended to prohibit the accumulation of mercury "hot spots" which could occur with the implementation of the US EPA's CAMR. Nevertheless, the mercury provisions of the proposed multi-pollutant regulation are intended to meet Delaware's obligations under the federal CAMR program by achieving actual reductions within Delaware, by way of prohibiting participation in the CAMR cap-and-trade program. The hard mercury mass caps established in the proposed multi-pollutant regulation are necessary to meet Delaware's state mercury cap specified under the federal CAMR requirements. The state mercury mass cap may not be increased, as any increase would make the proposed regulation unable to satisfy CAMR requirements.

It should be pointed out that the CAIR and CAMR cap-and-trade programs establish "soft" mass emissions caps. Under these programs, individual units are assigned mass emission caps in the form of allowances. However, under the provisions of a cap-and-trade program, affected units may exceed their assigned caps by any amount and remain in compliance with the cap-and-trade program by purchasing offsetting allowances on the open market. Under such a program mass emission from any given unit or state may increase while remaining in compliance with the cap-and-trade program. Therefore it

should be kept in mind when reading this document that when there is discussion of CAIR and CAMR mass caps, these are not hard caps but rather represent the level above which affected units must pay for additional emissions by purchasing offsetting emissions allowances.

It should also be noted that regulations addressing CO_2 emissions may be separately developed as a result of Delaware's participation in the Regional Greenhouse Gas Initiative (RGGI). DNREC is in the process of evaluating the effects of the proposed multi-pollutant regulation on fine particulate emissions, and whether the proposed emission limits will satisfy primary PM related Reasonable Available Control Technology (RACT) and Best Available Retrofit Technology (BART) requirements, in order to determinate of whether additional rulemaking will be necessary to address primary PM for PM nonattainment and Regional Haze requirements.

The proposed multi-pollutant regulation is just one of several efforts underway to reduce emissions from Delaware sources in order to meet the requirements of the Reasonable Further Progress Plan and facilitate attainment of the 8-hr ozone and $PM_{2.5}$ NAAQS. Some of these other efforts include emission controls for large industrial and refinery boilers, emission controls for electric generation peaking units, emission controls for small stationary generators, crude oil lightering controls, reduction of volatile organic compound (VOC) content of Architectural and Industrial Maintenance Coatings and Consumer Products, and adopting statewide limits for fuel sulfur content.

Electric Generating Units Affected by the Proposed Multi-Pollutant Regulation

The proposed Electric Generating Unit (EGU) Multi-Pollutant Regulation affects coal-fired and residual oil-fired electric generating units with nameplate capacity of 25 MW or larger located in Delaware as of the effective date of the regulation. The following table identifies the eight units affected by this regulation:

Facility	**Unit**	**County**	**Primary Fuel**
Edge Moor	3	New Castle	Coal
Edge Moor	4	New Castle	Coal
Edg	5	New	Res

e M o o r		C a s t l e	i d u a l O i l
I n d i a n R i v e r	1	S u s s e x	C o a l
I n d i a n R i v e r	2	S u s s e x	C o a l
I n d i a n R i v e r	3	S u s s e x	C o a l

Indian River	4	Sussex	Coal
McKee Run	3	Kent	Residual Oil

Pollutants Impacted By the Proposed Multi-Pollutant Regulation

The proposed multi-pollutant regulation establishes emissions limitations for nitrogen oxides (NO_X), sulfur dioxide (SO_2), and mercury from affected electric generating units. Each of these pollutants has a negative impact on the public health and welfare, as discussed below. Additionally, these pollutants are precursors to the formation of secondary fine particulate ($PM_{2.5}$) pollution, i.e. nitrates and sulfates, which also have a negative impact on the public heath and welfare. Therefore the emission limitations established in the proposed multi-pollutant regulation will result in reduced secondary $PM_{2.5}$ in the form of nitrates and sulfates (discussed in detail below). Additionally, there will be ancillary benefits of any installed control equipment on other pollutants. For example, wet scrubbers will reduce the emission of direct $PM_{2.5}$, hydrochloric (HCL) and hydrofluoric (HF) acids.

Nitrogen Oxides (NO_X)

Nitrogen oxides (NO_X) is a generic term for a group of reactive gasses that are composed of nitrogen and various amounts of oxygen (including nitrogen oxide and nitrogen dioxide). NO_X is formed in the combustion process as a result of high temperature reactions of nitrogen in the fuel, and nitrogen in the ambient combustion air, with oxygen in the combustion air. Uncontrolled, higher nitrogen content fuels, such as coal and residual fuel oil, tend to result in higher NO_X emissions than lower nitrogen content fuels (such as natural gas). NO_X causes, or contributes to, a wide variety of health and environmental impacts.

NO_X contributes to the formation of ground level ozone (smog) by reacting with volatile organic compounds (VOC's) in the presence of heat and sunlight. Short term exposure to ozone can cause rapid, shallow breathing and related airway irritation, coughing, wheezing, shortness of breath, and exacerbation of asthma, particularly in sensitive individuals and asthmatic children. Short term exposure also suppresses the immune system, decreasing the effectiveness of bodily defenses against bacterial infections. Research studies indicate that markers of cell damage increase with ozone exposure. Some studies suggest that there is a link between ozone exposure and premature death of adults and infant death. Other studies indicate a link between ozone and premature birth and adverse birth outcome, cardiovascular defects, and adverse changes in lung structure development in children.

Children, the elderly, those with chronic lung disease, and asthmatics are especially susceptible to the pulmonary effects of ozone exposure.

Ozone also adversely affects trees and vegetation and can cause reduced crop yields.

In its CAIR analysis, the US EPA identified Delaware sources as contributing to 8-hour ozone standard non-attainment in thirteen areas in three states.

NO_2, a constituent of NO_X, is itself a harmful gas that irritates the lungs and upper respiratory system and lowers resistance to respiratory infections. NO_2 can be fatal in high concentrations.

NO_X reacts with other substances in the atmosphere to form acids that contribute to acid rain. Acid rain can damage cars and structures, and contribute to bodies of water becoming acidic and unsuitable for many fish.

NO_X precipitation can contribute to increased nitrogen loading in water bodies, particularly coastal estuaries, and upset the chemical balance of nutrients used by aquatic plants and animals. This can contribute to oxygen depletion which has adverse effects on fish and shellfish populations.

NO_X also contributes to fine particle matter concentrations in the atmosphere, which can adversely affect health and contribute to visibility impairment. The effect of fine particles on health is separately addressed.

References:

Children at Risk, How Air Pollution from Power Plants Threatens the Health of America's Children, *Physicians for Social Responsibility, April, 2002,* *http://www.envirohealthaction.org/upload_files/ChildrenatRisk.pdf#search='children%20at%20risk%20physicians%20for%20social'*

State of the Air 2005, *American Lung Association* *http://lungaction.org/reports/sota05_full.html*

Noxious NOx, *Health & Clean Air Newsletter, Summer-Fall 2003 Newsletter,* *http://www.healthandcleanair.org/newsletters/summer2003.html*

Health Effects of Criteria Air Pollutants from Power Plants 2002, *Jefferson H Dickey MD* *http://psr.igc.org/nrtb-power-plants1.htm*

Technical Support Document for the Final Clean Air Interstate Rule, Air Quality Modeling, *US EPA, March 2005,* *http://www.epa.gov/cair/pdfs/finaltech02.pdf*

Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options, *STAPPA/ALAPCO, March 2006:* *http://www.4cleanair.org/PM25Menu-Final.pdf*

Sulfur Dioxide (SO_2)

Sulfur dioxide (SO_2) is a pungent, poisonous gas that is produced in the combustion process by chemical reactions with the sulfur contained in the fuel being combusted.

Uncontrolled, higher sulfur content fuels, such as coal and residual fuel oil, tend to result in higher SO_2 emissions than lower sulfur content fuels (such as natural gas). SO_2 causes, or contributes to, a wide variety of health and environmental impacts.

SO_2 is an irritant that studies have shown to exacerbate respiratory disease such as asthma, coughing, wheezing, shortness of breath, and reduced lung function. Inhalation of SO_2 is associated with upper respiratory symptoms including nasal congestion and inflammation. Studies have linked SO_2 exposure to bronchial reactions, reduced lung function, and premature death.

SO_2 gas may be toxic following only a few minutes of exposure. Exercising asthmatics may experience lung constriction within five to ten minutes of exposure.

Children, the elderly, those with chronic lung disease, and asthmatics are especially susceptible to the effects of SO_2 exposure.

SO_2 has been associated with premature birth, low birth weight and increased risk of premature death at low levels of exposure. Reproductive effects such as reduced sperm quality have also been linked to sulfur dioxide exposure.

Studies indicate that SO_2 tends to have more toxic effects when acidic pollutants, liquid or solid aerosols, and particulates are also present.

SO_2 can react with other chemicals in the air to form sulfate particles. When breathed, these sulfate particles gather in the lungs and are associated with increased respiratory symptoms and disease, difficulty in breathing, and premature death.

SO_2 emissions are a contributor to acid rain by the reaction of the SO_2 with other chemicals in the atmosphere to form acids. Acid rain damages forests and crops, changes the makeup of soil, and makes lakes and streams acidic and unsuitable for fish. Ecosystem damage can occur and cause species shift in affected areas.

SO_2 has been shown to injure many plant species at low levels of exposure. Some of the most sensitive plants can be found in Delaware, including pines, alfalfa, and blackberry. SO_2 contributes to reduced visibility by contributing to the formation of sulfates in the atmosphere.

SO_2 is a $PM_{2.5}$ precursor, and the predominate $PM_{2.5}$ source in the summer. $PM_{2.5}$ can adversely affect health and contribute to visibility impairment. The effect of fine particles on health is separately addressed.

References:

Ambient Air Pollution and Pregnancy Outcomes: A Review of the Literature*, Bobak et al, Environmental Health Perspectives Volume 113, Number 4, April 2005*

http://www.ehponline.org/members/2005/6362/6362.html

***Children at Risk, How Air Pollution from Power Plants Threatens the Health of America's Children**, Physicians for Social Responsibility, April, 2002, http://www.envirohealthaction.org/upload_files/ChildrenatRisk.pdf#search='children%20at%20risk%20physicians%20for%20social'*

***Health Effects of Criteria Air Pollutants from Power Plants 2002,** Jefferson H Dickey MD http://psr.igc.org/nrtb-power-plants1.htm*

***Health and Environmental Impacts of SO2**, US EPA, http://www.epa.gov/air/urbanair/so2/hlth1.html*

***Sulfur Dioxide: Evaluation of Current California Air Quality Standards With Respect to Protection of Children**, Koenig and Mar, September 01, 2000, http://www.oehha.ca.gov/air/pdf/oehhaso2.pdf#search='Sulfur%20Dioxide%3A%20Evaluation%20of%20Current%20California%20Air%20Quality%20Standards%20With%20Respect%20to%20Protection%20of%20Children'*

***Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options**, STAPPA/ALAPCO, March 2006: http://www.4cleanair.org/PM25Menu-Final.pdf*

***Using Factor Analysis to Attribute Health Impacts to Particulate Pollution Sources**, Grahame(USDOE) and Hidy (Envair/Aerochem), revised 7/2/03, http://www.netl.doe.gov/technologies/coalpower/ewr/pubs/Grahame&Hidy_PM25paper.pdf#search='oil%20combustion%20emissions%20health'*

Mercury

Mercury is a naturally occurring heavy metal. Elemental mercury is a constituent of coal, so that mercury may be emitted to the atmosphere from power plants that combust coal. Elemental mercury is also present in some residual fuel oils, and may be emitted during the combustion process. The mercury content in residual fuel oil is generally much lower than the mercury content in coal.

Methylmercury is an organic formed when the elemental mercury makes its way to rivers, lakes and oceans where aquatic microbes convert the elemental mercury to methylmercury through a biochemical reaction. The methylmercury may then accumulate in fish and shellfish, leading to dietary exposure to methylmercury through consumption of affected fish and shellfish. Methylmercury is a neurotoxin that interferes with brain development. It readily crosses the placenta, and fetal blood levels may be equal to or slightly higher than maternal levels. It is actively transported to the fetal brain where it interferes with nerve cell differentiation and division by binding with DNA and RNA. It also interferes with nerve cell migration and prevents the development of normal brain structure. High dose exposure during fetal development can result in low

birth weight, small head circumference, severe mental retardation, cerebral palsy, deafness, blindness, and seizures. Severely affected children may be born to mothers who exhibited no symptoms of methylmercury toxicity during pregnancy.

Lower dose exposure from maternal consumption of methylmercury contaminated foods may cause more subtle neurodevelopmental damage that is not evident until later in childhood. Recent studies have found that prenatal exposure has caused or contributed to deficits in fine motor function, attention span, visual-spatial abilities, and memory.

Infants and children are more potentially susceptible to methylmercury neurotoxicity than older children or adults because the brain continues to grow and develop dramatically for the first several years of life. Infants and children may be exposed through breast milk and other foods in their diet.

A study conducted in Texas, fourth in states of highest reported mercury emissions, concluded that there was a significant increase in the rates of special education students and autism rates associated with increases in environmentally released mercury. The study indicated that for each 1000lb of environmentally released mercury, there was a 43% increase in the rate of special education services and a 61% increase in the rate of autism.

Mature nervous systems can be adversely and permanently affected by methylmercury. Methylmercury causes nerve cell death and scarring in selected areas of the brain. Severity of the effects increases with increased exposure. Effects from low to moderate chronic exposure range from numbness and tingling of fingers, toes, mouth and lips to stumbling and generalized weakness. More acute exposures can cause a range of effects from decreased vision and hearing, tremor, and finally coma and death at high exposures.

Some information suggests that there is a link between methylmercury exposure and increased risk of high blood pressure, heart rate abnormalities, and heart disease. Information suggests that these symptoms develop following exposure during fetal development as well during adulthood. More research is being conducted in this area.

Mercury contamination of fish across the United States is so pervasive that health departments in 45 states have issued fish consumption advisories. Eleven states have consumption advisories for every inland water body for at least one fish species. Eleven states have also issued advisories urging women and children to limit consumption of canned tuna.

The State of Delaware Division of Fish and Wildlife has issued fish consumption advisories. In its 2006 Delaware Fish Consumption Advisories, mercury has factored into consumption advisories for fish in the Delaware River, the lower Delaware River and Delaware Bay, Saint Jones River, Dover's Silver Lake, Becks Pond, and Delaware's Atlantic coastal waters including the inland bays.

Some research also indicates that bioaccumulation of mercury is also occurring in some non-fish eating species, including elevated mercury levels in forest songbirds.

References:

Health Effects of Methylmercury, *Physicians for Social Responsibility, copyright 2004, http://www.cdphe.state.co.us/ap/comanche/commentsbeforehearing/glustrom17-mercury2/PSRFactSheetonHealthEffectsofMethylMercury.pdf#search='Health%20Effects%20of%20Methylmercury%2C%20Physicians%20for%20Social%20Responsibility'*

What You Need to Know About Mercury in Fish and Shellfish, *U.S. Food and Drug Administration and the U.S. Environmental Protection Agency, EPA-823-F-04-009, http://www.epa.gov/waterscience/fish/MethylmercuryBrochure.pdf*

Environmental mercury release, special education rates, and autism disorder: an ecological study of Texas, *Palmer et al, published in Health and Place, March 2005 http://www.safeminds.org/research/library/Palmer-et-al-Texas-Autism-Mercury-Link.pdf#search='health%20and%20place%20claudia%20miller'*

Children at Risk, How Air Pollution from Power Plants Threatens the Health of America's Children, *Physicians for Social Responsibility, April, 2002, http://www.envirohealthaction.org/upload_files/ChildrenatRisk.pdf#search='children%20at%20risk%20physicians%20for%20social'*

State of Delaware Division of Fish & Wildlife ***Fish Consumption Advisories*** *(http://www.fw.delaware.gov/Fisheries/Advisories.htm)*

State of Delaware Division of Fish & Wildlife, ***Fish Consumption Advisories Chart,*** *http://www.fw.delaware.gov/Fisheries/AdvisoriesChart.htm*

National Medical and Public Health Groups Sue EPA To Prevent Future Mercury Exposure, American Nurses Association Press Release, June 14, 2005, http://www.nursingworld.org/pressrel/2005/pr0614.htm

Pennsylvania's Proposed Mercury Reduction Rule, PA DEP press release, http://www.depweb.state.pa.us/mercury/site/default.asp

Mercury Connection, The extent and effects of mercury pollution in northeastern North America, *BioDiversity Research Institute, http://www.nwf.org/wildlife/pdfs/MercuryinWildlifeReport.pdf*

Fine Particulate ($PM_{2.5}$)

While not being directly addressed by this proposed multi-pollutant regulation, fine particulate matter ($PM_{2.5}$) emissions will be impacted by the reductions in SO_2 and NO_X emissions that are being addressed in this regulation. $PM_{2.5}$ indicates particulate matter of 2.5 micron diameter or smaller. $PM_{2.5}$ generally originates from the combustion of fossil fuels, and can be formed from sulfate and nitrate aerosols when SO_2 and nitrogen oxides condense in the atmosphere. $PM_{2.5}$ can also combine with other substances in the atmosphere to become a complex, harmful mixture of sulfur, nitrogen, carbon, acids, metals, and airborne toxics.

One study indicates that for residual oil-fired generating units, a significant portion of the total $PM_{2.5}$ is directly emitted from the source as metallic sulfates and is not the result of atmospheric interaction. The study indicates that approximately 50% of the $PM_{2.5}$ from residual oil-fired units is directly emitted from the stack as residual oil fly ash.

Short term exposure to high particulate levels has been shown to aggravate lung disease causing asthma attacks and acute bronchitis, increases susceptibility to respiratory infections, and cause heart attacks and arrhythmias in people with heart disease. Long term exposure to high particulate exposure has been shown to increase respiratory symptoms (coughing, breathing difficulty), cause decreased lung function, aggravate asthma, cause development of chronic bronchitis or chronic obstructive lung disease, cause irregular heart beat, increase the rate of heart attacks, and increase the rate of premature death in people with heart or lung disease.

The health effects of particulate matter are strongly linked to particle size. Particles from fossil fuel combustion are likely to be most dangerous because they are small enough to be inhaled deeply into the lungs. There the particulate can settle where the body's natural clearance mechanisms can't remove them. Constituents in these small particles may also be more chemically active and acidic, thereby causing more damage. The smallest particles may be so small that they pass through the lungs into the blood stream, just like oxygen molecules.

This is true even of particulate emissions from oil-fired power plants, as discussed in a study conducted in California. Most oil-fired generating units utilize relatively inefficient particulate controls regarding fine particulate generated during combustion. The study indicated that fine oil fly ash has been shown to be highly biologically active, is relatively toxic to cells, and may contain mutagenic constituents. The report stated, "Since the fine (respirable) ash particles consisted primarily of metallic sulfates, including the biologically important trace metals vanadium, nickel, manganese, cobalt, and magnesium, and were 85% soluble in water, relatively high solubility in lung fluids upon inhalation deposition is to be expected."

Medical studies indicate that particulate matter may affect children even before they are born. There is evidence that low birth weight and premature births may be affected by exposure of a developing fetus to particulate matter in utero. Researchers have estimated

that 11% of infant mortality in the US is attributable to exposure to particulate matter, even at low to moderate levels. Medical studies have also linked exposure to particulate matter to slow lung function growth in children.

In a letter to Thomas Carper, Jaime H. Rivera, Director Delaware Health and Social Services, stated, "EPA's consultants estimate that fine particle pollution from power plants shortens the lives of 95 Delaware residents each year. In our state alone, pollution from power plants causes 13,106 lost work days, 87 hospitalizations and 2,256 asthma attacks every year, 99 of which are so severe they require emergency room visits." It was further stated in the letter, "In Delaware, 142,099 children live within 30 miles of a plant, the area in which the greatest health impacts are felt. Additionally, researchers have found that infants in areas of high particulate matter pollution face a 26 percent increased risk of Sudden Infant Death Syndrome and a 40 percent increased risk of respiratory death."

The Delaware Health and Social Services (DHSS) has indicated that for 2003, the prevalence of asthma in Delaware is approximately the same as the national prevalence in 2003. DHSS indicated that in 2000 and 2001, the most recent years for which data was available, there were 17 deaths per year from asthma in Delaware. DHSS estimated that statewide charges for asthma treatment and medications could be as high as $25 to $30 million per year.

DHSS has also indicated that Delaware's average age adjusted cancer incidence rate for the period 1998 to 2002 is approximately 4.1% higher than the estimated US average age adjusted rate, and Delaware's cancer mortality rate for the same period is approximately 6.9% higher than the estimate US rate. For the 1998 to 2002 age adjusted average, Delaware's lung cancer mortality rate was 62.1 per 100,000 compared to the US average of 55.7 per 100,000.

In its CAIR analysis, the US EPA indicated that the combined emissions of New Jersey and Delaware contributed to $PM_{2.5}$ non-compliance in areas in 14 states (including Delaware) and the District of Columbia.

***References**:*

***Children at Risk, How Air Pollution from Power Plants Threatens the Health of America's Children**, Physicians for Social Responsibility, April, 2002, http://www.environhealthaction.org/upload_files/ChildrenatRisk.pdf#search='children%20at%20risk%20physicians%20for%20social'*

***Toxicological Investigation of Fine Particle Emissions from Oil-Fired Power Plants**, University of California, Davis, for California Air Resources Board, October 1982, ftp://ftp.arb.ca.gov/carbis/research/apr/past/a8-144-31_exsum.pdf*

State of the Air 2005, *American Lung Association*
http://lungaction.org/reports/sota05_full.html

Health Effects of Criteria Air Pollutants from Power Plants 2002, *Jefferson H Dickey MD http://psr.igc.org/nrtb-power-plants1.htm*

Ambient Air Pollution and Pregnancy Outcomes: A Review of the Literature, *Bobak et al, Environmental Health Perspectives Volume 113, Number 4, April 2005*
http://www.ehponline.org/members/2005/6362/6362.html

Urban Air: Health Effects of Particulates, Sulfur Dioxide, and Ozone, *World Resources Institute http://pubs.wri.org/pubs_content_text.cfm?ContentID=1308*

Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality, *Health Effects Institute, July 2000*
http://es.epa.gov/ncer/science/pm/hei/Rean-ExecSumm.pdf

Letter, From Jaime H. Rivera, Director, Delaware Health and Social Services, to Thomas Carper, US Senate, dated February 9, 2005, http://www.awm.delaware.gov/NR/rdonlyres/3B571C5A-080A-43D7-A3F2-032AE9748BD7/876/CorrespondenceDHSSletter.pdf

How Energy Policies Affect Public Health, *Joseph Romm, PhD, and Christine Ervin, MS*
http://solstice.crest.org/efficiency/joe_romm/health/

The Burden of Asthma in Delaware, *Delaware Health and Social Services, August 2005*
http://www.dhss.delaware.gov/dhss/dph/dpc/files/asthmaburden_rpt.pdf#search='the%20burden%20of%20asthma%20in%20delaware'

Delaware Cancer Incidence and Mortality Rates, *Delaware Division of Public Health , April 2005*
http://www.dhss.delaware.gov/dhss/dph/dpc/files/cancer_rpt05.pdf

Regulatory Impact Analysis for the Final Clean Air Interstate Rule, *US EPAUS EPA, EPA-452/R-05-002, March 2005 http://www.epa.gov/cair/pdfs/finaltech08.pdf*

Inclusion of Delaware and New Jersey in the Clean Air Interstate Rule, *40 CFR Parts 51 and 96, Federal Register Vol. 71, No. 82, Friday April 28, 2006,*
http://a257.g.akamaitech.net/7/257/2422/01jan20061800/edocket.access.gpo.gov/2006/pdf/06-2750.pdf

Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options, *STAPPA/ALAPCO, March 2006: http://www.4cleanair.org/PM25Menu-Final.pdf*

Recommendations in support of primary fine particle National Ambient Air Quality Standards to protect northeastern populations*, NESCAUM, July 1, 2005,* *http://www.nescaum.org/documents/final-nescaum-pm2-5-standards-white-paper.pdf*
Biologic Effects of Oil Fly Ash*, Ghio et al, Environmental Health Perspectives Supplements, Volume 110, Number S1, February 2002,* *http://ehponline.org/members/2002/suppl-1/89-94ghio/ghio-full.html*

Using Factor Analysis to Attribute Health Impacts to Particulate Pollution Sources*, Grahame(USDOE) and Hidy (Envair/Aerochem), revised 7/2/03, http://www.netl.doe.gov/technologies/coalpower/ewr/pubs/Grahame&Hidy_PM25paper.pdf#search='oil%20combustion%20emissions%20health'*

Global Warming in the Twenty-First Century: An Alternative Scenario*, Hansen et al, Proceedings of the national Academy of Sciences of the United States of America, August 29, 2000,* *http://www.pnas.org/cgi/content/full/97/18/9875*

Characterization of Fine Particulate Matter Produced by Combustion of Residual Fuel Oil*, Huggins et al, Journal of the Air & Waste Management Association, July 2000,* *http://www.cffs.uky.edu/PM/Pubs/JAWMA%20v50p1106y2000.pdf#search='characterization%20of%20fine%20particulate%20matter%20produced%20by%20combustion'*

Dirty Air, Dirty Power*, Clean Air Task Force, June 2004,* *http://www.cleartheair.org/dirtypower/docs/dirtyAir.pdf*

EPA Orders Air Quality Improvements at Mystic Station Power Plant In Everett*, US EPA Press Release, March 6, 2002,* *http://www.epa.gov/region1/pr/2002/mar/020301.html*

Hydrochloric Acid (HCl) and Hydrofluoric Acid (HF)

While not specifically targeted by the proposed multi-pollutant regulation, power plant emissions of hydrochloric acid (HCl) and hydrogen fluoride (HF) will be impacted by the proposed regulation. HCl and HF are identified as hazardous air pollutants that are emitted from power plants, and emissions are reported under the Toxics Release Inventory (TRI). HCl emissions are a function of the chlorides (Cl) in the fuel, and both coal and, to a lesser extent, residual fuel oil contain varying amounts of chlorides. Similarly, HF emissions are a function of the fluoride (F) in the fuel, and both coal and, to a lesser extent, residual fuel oil contain varying amounts of fluoride.

Low level HCL exposure can be corrosive to the eyes, skin, and mucous membranes. Acute inhalation exposure may cause coughing, hoarseness, inflammation and ulceration of the respiratory tract, chest pain, and pulmonary edema. HCl is emitted from the power plant stack as an acid aerosol and, once released to the atmosphere, HCl tends to be relatively short-lived (one to five days) as it is very soluble and reacts readily with

ammonia (NH3) or alkaline cations (such as Ca or K) to form chloride salts. The formation of the chloride salts in the atmosphere is contributor to particulate matter in the ambient air. Delaware's 2004 Toxics Release Inventory indicated that the Edge Moor Power Plant (combined with the Hay Road Power Plant) and the Indian River Power Plant collectively emitted over 5 million tons of HCL aerosol in 2004. This represented nearly 93% of the total 2004 HCl emissions in Delaware.

Low level HF exposure can cause irritation and congestion of the nose, throat and bronchi. Acute inhalation of HF can cause severe respiratory damage, and ingestion of high doses of fluorides can cause convulsions, cardiac arrhythmias, and death. HF is emitted from the power plant stack as an acid aerosol. HF in the atmosphere can be absorbed by moisture in the atmosphere and return to the ground as precipitation. The fluorides can then bioaccumulate in plants and animals. Delaware's 2004 Toxics Release Inventory indicated that the Edge Moor Power Plant (combined with the Hay Road Power Plant) and the Indian River Power Plant collectively emitted nearly 256 thousand tons of HF in 2004. This represented approximately 99.8% of the total 2004 HF emissions in Delaware.

Conventional flue gas desulfurization (FGD) scrubbers are effective at removing HCl and HF from power plant flue gasses before the gasses are discharged into the atmosphere. Scrubbers have been demonstrated to remove greater than 90% of inlet HCl from coal-fired, utility sized boilers. Testing has indicated that scrubbers can also remove greater than 70% of inlet HF from coal-fired, utility sized boilers. Therefore it is anticipated that significant reductions of HCl and HF emissions will result as a co-benefit of the installation of scrubbers on the coal-fired units subject to the proposed multi-pollutant regulation.

References:

Hydrochloric Acid (Hydrogen Chloride), US EPA Technology Transfer Network, Air Toxics Website, http://www.epa.gov/ttn/atw/hlthef/hydrochl.html

Hydrogen Fluoride, US EPA Technology Transfer Network, Air Toxics Website, http://www.epa.gov/ttn/atw/hlthef/hydrogen.html

***2004 Delaware Toxics Release Inventory, Data Detail**, March 2006, http://www.serc.delaware.gov/information/TRI/2004/04trirpthtm.shtml*

***Hydrogen Chloride (HCl) Emissions from Maryland Utility Boilers**, Maryland Power Plant Research Program, June 1999, http://esm.versar.com/PPRP/hcl/pprp-118pdf.pdf*

***Boneseeker: Hydrogen Fluoride or Hydrofluoric Acid**, Alex Revchuk, Novemebr 15, 2005, http://www.ph.ucla.edu/ehs/student%20hazards/hydrogen%20fluoride.pdf#search='Boneseeker%3A%20Hydrogen%20Fluoride'*

Predicted CAIR and CAMR Cap-and-Trade Program Effects on Delaware EGUs

The federal Clear Air Interstate Rule (CAIR) was established to achieve significant reductions in NO_X and SO_2 from subject power plants on a regional basis through the establishment of a cap-and-trade program. The cap-and-trade program allows subject sources the option of reducing NO_X and SO_2 emissions to required levels, purchase emissions "allowances" instead of making reductions, or a combination of reduction and allowance purchase. Units that "over-comply" can sell their excess allowances on an open market to units that determine to not meet the applicable mass caps.
The Clean Air Mercury Rule (CAMR) is also a cap-and-trade program, with provisions similar to CAIR, and is intended to reduce power plant mercury emissions on a regional basis.

The CAIR and CAMR programs anticipate that this free market approach would result in emissions reductions occurring at units where it is most cost-effective to install emissions controls, and other units would purchase the excess allowances as their most cost effective means of compliance with the cap-and-trade program requirements. However, such an approach can actually increase the emissions in a given area and potentially exacerbate local air quality problems. Because of this the EPA leaves much discretion to the States, and indicates that States must develop specific local reduction requirements where CAIR and/or CAMR is not adequate.

To predict the effects of CAIR on the electric generating units in the affected region, the EPA utilized the Integrated Planning Model (IPM), a sophisticated computer model, to predict emission rates for units subject to CAIR. Economics play a role in the calculated results of the IPM model, so that on a unit by unit basis application of emissions controls are predicted and integrated into the results of all units in the regional analysis. For Delaware, the IPM runs predicted that there would be few controls added to Delaware units. The IPM also predicted that Delaware coal-fired units would experience significant increases in capacity factor, which, when combined with few emissions control installations, results in increased annual emissions. The following table compares, for units subject to the proposed multi-pollutant regulation, the actual 2002 mass emissions, the annual mass caps provided by CAIR, and the IPM (final CAIR runs) predicted annual emissions. The table also compares IPM predicted capacity factors (on a heat input basis) to actual 2002 data.

	Phase I	**Phase II**

2002 Actual NOx (*tons*)	8143	8143
CAIR NOx Allocation (*tons*	3341	2842

)		
IPM Predicted NOx *(tons)*	10641	10984
2002 Actual SO2 *(tons)*	31184	31184
C	2	1

AIR SO_2 Allocation *(tons)*	1638	5146
IPM Predicted SO_2 *(tons*	45132	46869

)		
2002 Avg. Cap. Fact. *(all units)*	26%	26%
2002 Avg. Cap. Fac	29%	29%

t. *(coal units)*		
IPM Predicted *(coal units only)*	70%	73%

Other IPM runs also included predicted mercury emissions. The following table provides a comparison of 2002 mercury emissions (estimated due to no requirement to

continuously monitor mercury emissions), CAMR allocations, and IPM predicted mercury emissions.

	Phase I	**Phase II**
2002 Estimated Hg *(lb)*	103	103
CAMR Allocation *(lb)*	138	53
IPM Predicted Hg *(lb)*	233	279

It is clear from the above information that EPA modeling predicts Delaware's coal-fired electric generating units will not reduce annual mass emissions as a result of CAIR and CAMR, but rather will increase the annual mass emissions of NO_X, SO_2, and mercury under CAIR and CAMR cap-and-trade programs. Such a mass emissions increase will seriously hinder Delaware's efforts to attain the NAAQS of ozone and fine particulate matter. For example, the Clean Air Act requires Delaware to significantly reduce daily NO_X emissions during the ozone season (May through September) in order to attain the 8-hour ozone standard in 2010. An annual emission increase can be reasonably assumed to lead to a daily emissions increase during the ozone season. Therefore, an annual increase in mass emissions is inconsistent with the Clean Air Act requirements, and detrimental to Delaware's overall efforts to achieve NO_X emissions reductions that are necessary to attain the 8-hour ozone standard in 2010.

This effect on Delaware sources resulting from a regional emissions cap-and-trade program is not unexpected. In 2003, the federal NO_X SIP Call established a regional ozone season NO_X cap-and-trade program that included all of the Delaware sources that are subject to the proposed multi-pollutant regulation. Under the NO_X SIP Call program, the subject sources were allocated NO_X emissions allowances based on historic heat input values and a 0.15 lb/MMBTU NO_X emission rate. As the NO_X SIP Call is a cap-and-trade program, affected sources were not required to attain the absolute value (limit) of the NO_X allocation, only to "balance" the account at the end of the season through allowance trade or purchase if necessary.

The following table identifies the NO_X SIP Call allocation for the sources subject to the proposed multi-pollutant regulation and the actual ozone season NO_X emissions for the year 2005.

Unit	**SIP Call NOx Rate (lb/MMBTU)**	**SIP Call NOx Allocation (tons)**	**2005 Ozone Season Avg NOx Rate (lb/MMBTU)**	**2005 Ozone Season NOx Mass Emissions (tons)**	**2005 Percent Change from Allocation (%)**
Edge Moor 3	0.15	234	0.275	313	34
Edge Moor 4	0.15	400	0.219	491	23
Edge Moor 5	0.15	601	0.304	716	19
Indian River 1	0.15	187	0.358	376	101
Indian River 2	0.15	193	0.36	364	89
Indian River 3	0.15	368	0.391	820	123

Indian River 4	0.15	727	0.304	1441	98
McKee Run 3	0.15	119	0.298	104	-13

It can be seen from the above table that with the exception of McKee Run Unit 3, all of the subject sources exceeded their allocations by significant margins. In the case of McKee Run Unit 3, it is evident that the average 2005 ozone season NO_X emission rate exceeded the 0.15 lb/MMBTU target, which indicates then that the unit's heat input (capacity factor) was very low for 2005 relative to the heat input baseline. Overall this indicates that even for the NO_X SIP Call emissions cap-and-trade program, Delaware sources generally found it more economical to purchase allowances rather than make actual emission reductions to the level of the program allocations. This tends to confirm the conclusions drawn from the IPM model results that indicate that under a cap-and-trade program, Delaware sources will find it economically advantageous to buy allowances rather than make reductions, and create the potential for emissions in Delaware to increase rather than decrease.

As discussed earlier, an increase in actual emissions is inconsistent with the Clean Air Act requirements and will hinder Delaware's efforts to attain the 8-hour ozone standard. Considering that the 8-hour ozone standard is much lower in magnitude and measured over a longer time frame than the previous 1-hour ozone standard, actual emission reductions are likely more critical for lowering the 8-hour ozone concentration in the ambient air.

***References**:*

IPM Parsed File EPA Final CAIR parsed for year 2010 (Final CAIR modeling),
http://www.epa.gov/airmarkets/epa-ipm/iaqr/ipm_finalcair2010parsed.xls

IPM Parsed File EPA Final CAIR parsed for year 2015 (Final CAIR modeling),
http://www.epa.gov/airmarkets/epa-ipm/iaqr/ipm_finalcair2015parsed.xls

IPM Run - CAIR/CAMR/CAVR PARSED_2010
http://www.epa.gov/airmarkets/mp/pssupport/CAIR_CAMR_CAVR_Parsed_2010.xls

IPM Run - CAIR/CAMR/CAVR PARSED_2015
http://www.epa.gov/airmarkets/mp/pssupport/CAIR_CAMR_CAVR_Parsed_2015.xls

***Fact Sheet, Clean Air Interstate Rule (CAIR)**, US EPA,*
http://www.epa.gov/cair/pdfs/cair_final_fact.pdf

***Air Pollution Control – Transport of Emissions of Nitrogen Oxides (NOx) and Sulfur Dioxide (SO2); Final Rule**, Federal Register Vol. 71, No. 82, Friday, April 28, 2006,*
http://a257.g.akamaitech.net/7/257/2422/01jan20061800/edocket.access.gpo.gov/2006/pdf/06-2692.pdf

Revision of December 2000 Clean Air Act Section 112(n) Finding Regarding Electric Utility Steam Generating Units; and Standards of Performance for New and Existing Electric Utility Steam Generating Units: Reconsideration, US EPA, 650-50-P, May 31, 2006, http://www.epa.gov/air/mercuryrule/pdfs/camr_recon_fr_final_053106.pdf

Modeling of Control Costs, Emissions, and Control Retrofits for Cost Effectiveness and Feasibility Analysis, *USEPA, OAR-2003-0053, March, 2005, http://www.epa.gov/airprogm/oar/interstateairquality/pdfs/finaltech07.pdf*

Analysis in Support of the Clean Air Interstate Rule Using the Integrated Planing Model, *USEPA, May 28, 2004, http://www.epa.gov/CAIR/pdfs/tsd.pdf*

Pennsylvania's Proposed Mercury Reduction Rule, PA DEP press release, http://www.depweb.state.pa.us/mercury/site/default.asp

Options for Controlling Mercury from Georgia Coal-Fired Power Plants: A Case for Stringent Mercury Control, *Beth Allgood, Southern Environmental Law Center, March 9, 2006, http://www.air.dnr.state.ga.us/airpermit/cair/downloads/SELC_Hg_presentation.pdf#search='Options%20for%20Controlling%20Mercury%20from%20Georgia%20CoalFired%20Power%20Plants%3A%20A%20Case%20for%20Stringent%20Mercury%20Control*

Need for Local Emission Controls

As detailed above, the federal Clear Air Interstate Rule (CAIR) and Clean Air Mercury Rule (CAMR) were established to achieve significant reductions in NO_X, SO_2, and mercury emissions from subject power plants on a regional basis through the establishment of cap-and-trade programs. The cap-and-trade programs allow subject sources the option of reducing NO_X and SO_2 emissions to required levels, purchase emissions "allowances" instead of making reductions, or a combination of reduction and allowance purchase. Any given state subject to the federal programs has the option of participating in the federal cap-and-trade programs or otherwise meeting that state's emissions budget caps through measures of the state's choosing.

However, the EPA has also indicated that even after the reduction in pollution transport across state lines as a result of the federal cap-and-trade programs, it may be necessary in some areas to take additional local action to meet the NAAQS health-based air quality standards for ozone and $PM_{2.5}$. In one of its CAIR technical support documents, the EPA has indicated that for New Castle County, DE, 37% of the 8-hr ozone loading is due to transport issues. Further, as discussed in the "Predicted CAIR and CAMR Cap-and-Trade Program Effects on Delaware EGUs" section above, EPA modeling predicts that NO_X, SO_2, and mercury emissions will increase under the federal cap-and-trade programs at the units subject to this proposed multi-pollutant regulation.

In its CAIR analysis, the US EPA indicated that Delaware sources contribute to $PM_{2.5}$ non-attainment in Delaware. A study conducted by Clarkson University for DNREC seems to confirm this statement, indicating that a residual oil-fired generating unit in Dover, DE may be contributing significantly (> 8 %) to $PM_{2.5}$ readings at the Martin Luther King Boulevard monitor in Wilmington, DE.

While there is no doubt that reductions in NO_X, SO_2, and mercury being transported into Delaware from other states will be of benefit to the health and welfare of Delaware's citizens, the EPA's modeling predicts that power plant emissions will increase in Delaware under the federal cap-and-trade programs. Delaware already has an emissions density of approximately 237 tons/yr/square mile, which according to the EPA is approximately 50% higher than that of Pennsylvania and approximately 10% higher than Maryland.

Investigations and studies at various locations in this country indicate that the pollution burden from any given power plant is at its greatest near that plant. The following are a few excerpts and summaries of the conclusions of several of these studies:

- A study (Estimated Public Health Impacts of Criteria Pollutant Air Emissions from the Salem Harbor and Brayton Point Power Plants) was conducted to evaluate the health impact of emissions and potential benefits of emissions reductions from two coal fired power plants in Massachusetts. Actual emissions from 1996 through 1998

were used as a baseline for comparison of applying BACT emission controls for SO_2, NO_X, and PM_{10}. One of the major findings indicated, "In general, ambient concentrations were greatest closest to the source for primary pollutants (within 5 miles for PM_{10} and SO_2) and peaked further downwind for secondary particles (approximately 20 miles)." Another finding was that, "Per capita health risks were greatest near the power plants and decreased with distance from the source." It was also stated that, "Secondary sulfate particles were responsible for a majority of the estimated health effects, associated with a relatively high SO_2 emission rate in comparison with other pollutants."

- A study (The Importance of Population Susceptibility for Air Pollution Risk Assessment: A Case Study of Power Plants Near Washington, DC) was conducted to estimate the magnitude and distribution of health benefits associated with the application of emission controls at five older power plants located in the Washington, DC area. The power plants are all located within 50km of Washington DC. The study compared actual 1999 emissions with emissions estimates based on the application of BACT technology on the same plants for SO_2, NO_X, and filterable PM. The study indicates, "For premature mortality, using non-stratified relative risks and homogeneous baseline mortality rates within counties, our central estimate is that emission reductions from the five power plants would lead to 210 fewer deaths per year. The estimated impact under the current emissions scenario is 270 deaths per year." The further indicates, "Approximately 16% of the mortality benefits accrue within 50 km of the power plants, largely related to the substantial contribution of secondary sulfates (62%) and nitrates (19%) to the total $PM_{2.5}$ exposures."

- A study in Texas (Environmental mercury release, special education rates, and autism disorder: an ecological study of Texas) investigated the relationship between local mercury emissions and special education and autism rates in schools. In its conclusion, the Texas report stated, "This study is among the first to demonstrate an association between environmentally released mercury at the county level and the rate of developmental disability."

- The Pennsylvania Department of Environmental Project issued a news release (May 31, 2006) indicating that data collected over an eight year period showed that mercury deposition tends to concentrate around local emission sources. In this case, the sources were coal fired power plants and local areas had an approximate 47% higher concentration in areas closer to the plants.

- The Massachusetts Department of Environmental Protection has reported a reduction in mercury in fish, and indicates the reduction is due to significant mercury emissions reductions from Massachusetts sources. Over a four year time period, an approximate 85% reduction in incinerator mercury emissions was followed by a 30% to 38% reduction in fish tissue mercury concentration.

- According to the Florida Department of Environmental Protection, there has been a significant drop in mercury levels in fish and wading birds in the Florida everglades.

The Florida DEP attributes the significant improvement to the regulatory-required installation of mercury control technology by industry in South Florida. It has been reported that between 1991 and 2000, the local mercury emissions in south Florida was reduced in excess of 90% and mercury deposition was estimated to have been reduced by 60%. Mercury concentrations in fish tissue were reported to have declined by approximately 75%.

- A presentation by Matthew Landis of the U.S. EPA discussed a mercury monitoring/modeling study conducted for an area near Steubenville, Ohio. In that presentation it was indicated that mercury wet deposition in the area was 75% attributable to local/regional anthropogenic sources, and that 65% was attributable to coal combustion.

- A study of the sulfate and metal concentrations of the $PM_{2.5}$ in the ambient air of Boston indicated that local residual oil-fired power plants were significant contributors to the pollution loading. Residual oil-fired units were found to be located approximately 8 km of both Boston and the location of the ambient air monitor. The study indicates that the potentially hazardous concentrations of transition metals with acid sulfates from the $PM_{2.5}$ of residual fuel-oil combustion represent a large health risk factor. The study indicates that $PM_{2.5}$ is a relatively significant local issue for residual oil-fired plants, as a significant portion of the total $PM_{2.5}$ is directly emitted from the stack as opposed to being formed down-wind due to atmospheric interaction.

- Computer "zero-out-modeling" has shown that Delaware emissions by themselves, which include significant emissions from coal and oil fired power plants, can cause exceedances of the federal ozone air quality standards in Delaware and in surrounding states.

Collectively, this information indicates that current power plant emissions in Delaware are significant, that the federal CAIR and CAMR cap-and-trade programs will result in increases in power plant emissions in Delaware and that local areas within Delaware may be negatively impacted by those existing and increased emissions. These emissions in Delaware would also be expected to negatively impact downwind states. This situation exemplifies the need for local controls to ensure Delaware's air quality problems are not exacerbated as a result of the regional cap-and-trade program.

Under the 8-hour ozone NAAQS, the entire state of Delaware is included in the Philadelphia-Wilmington-Atlantic City (PWAC) non-attainment area. The PWAC non-attainment area is required by the Clean Air Act to attain the ozone standard by 2010. In 2002, Delaware's electric generating units contributed approximately 61% of the state's total point source NO_X emissions.

References:

***Environmental mercury release, special education rates, and autism disorder: an ecological study of Texas**, Palmer et al, published in Health and Place, March 2005*
http://www.safeminds.org/research/library/Palmer-et-al-Texas-Autism-Mercury-Link.pdf#search='health%20and%20place%20claudia%20miller

***Data collected Over Eight Years Show Mercury Levels 47% Higher In Areas Near Power Plants, Pennsylvania Department of Environmental Protection**, May 31, 2006*
http://www.depweb.state.pa.us/news/cwp/view.asp?a=3&q+507034&pp=12&n=1

***The Importance of Population Susceptibility for Air Pollution Risk Assessment: A Case Study of Power Plants Near Washington, DC**, Levy et al, Environmental Health Perspectives, December 2002*
http://www.cleartheair.org/reports/dc_study.pdf#search='The%20Importance%20of%20population%20susceptibility'

***Estimated Public Health Impacts of Criteria Pollutant Air Emissions from the Salem Harbor and Brayton Point Power Plants**, Levy et al. May 2000*
http://www.airimpacts.org/documents/local/plant.pdf#search='Levy%20Massachusetts%20Emissions'

***Freshwater Fish in Mass. Lakes Show Reductions in Mercury**, The Massachusetts Department of Environmental Protection Newsletter*
http://www.mass.gov/dep/public/publications/mercury.htm

***Temporal Responses of Fish Tissue Mercury Concentrations to Local Mercury Atmospheric Mercury Emissions Reductions from Incinerators**, Hutcheson et al, Presentation to ECOS Annual Meeting, September 2005.*
http://www.ecos.org/files/1618_file_ECOS_Hutcheson_Fish_HgWebsite_Version.pdf

Testimony of Kenneth A. Colburn, executive director of NESCAUM, to the U.S. House of Representatives Committee on Science, Subcommittee on Environment, Technology, and Standards, November 5, 2003,
http://www.house.gov/science/hearings/ets03/nov05/colburn.pdf#search='Testimony%20of%20Kenneth%20A.%20Colburn'

***Ambient Measurements to Support Coal Combustion Emission Research,** presented by Matthew S. Landis, E.S. EPA Office of Research and Development, October 2005,*
http://www.dep.state.pa.us/dep/deputate/airwaste/aq/regs/docs/landis_beijing_talk_Oct_05.pdf

***Florida Everglades Study Reveals Decline in Mercury Levels**, Florida Department of Environmental Protection, November 2003,*
http://www.dep.state.fl.us/secretary/news/2003/nov/1106.htm

Integrating Atmospheric Mercury Deposition with Aquatic Cycling in South Florida: An approach for conducting Total Maximum Daily Load Analysis for an

atmospherically derived pollutant, *Florida Department of the Environment, October 2002, revised November 2003*
http://www.dep.state.fl.us/secretary/news/2003/nov/pdf/mercury_report.pdf

Technical Support Document for the Final Clean Air Interstate Rule, Air Quality Modeling, *US EPA, March 2005: http://www.epa.gov/cair/pdfs/finaltech02.pdf*

Inclusion of Delaware and New Jersey in the Clean Air Interstate Rule, *40 CFR Parts 51 and 96, Federal Register Vol. 71, No. 82, Friday April 28, 2006*
http://a257.g.akamaitech.net/7/257/2422/01jan20061800/edocket.access.gpo.gov/2006/pdf/06-2750.pdf

Background Information, EPA Proposal to Regulate Mercury Emissions from Power Plants, Izaak Walton League, *February 19, 2004,*
http://www.iwla.org/fileadmin/template/docs/02-04_mercury.doc

2002 MANE-VU Emissions Inventory Version 3 Summaries, *MARAMA, updated May 30, 2006,*
http://www.marama.org/visibility/Inventory%20Summary/2002EI-Ver3Sum.html

Analysis of Speciation Trends Network Data Measured at the State of Delaware, *Hopke & Kim, Center for Clean Air Resources Engineering and Science, Clarkson University, January 20, 2005*

National Medical and Public Health Groups Sue EPA To Prevent Future Mercury Exposure, *American Nurses Association Press Release, June 14, 2005,*
http://www.nursingworld.org/pressrel/2005/pr0614.htm

Power Plants Big Influence in Regional Mercury Emissions, *Yale School of Forestry and Environmental Studies,*
http://environment.yale.edu/doc/2303/power_plants_big_influence_in_regional/

Using Factor Analysis to Attribute Health Impacts to Particulate Pollution Sources, *Grahame(USDOE) and Hidy (Envair/Aerochem), revised 7/2/03,*
http://www.netl.doe.gov/technologies/coalpower/ewr/pubs/Grahame&Hidy_PM25paper.pdf#search='oil%20combustion%20emissions%20health'
Characterization of Fine Particulate Matter Produced by Combustion of Residual Fuel Oil, *Huggins et al, Journal of the Air & Waste Management Association, July 2000,*
http://www.cffs.uky.edu/PM/Pubs/JAWMA%20v50p1106y2000.pdf#search='characterization%20of%20fine%20particulate%20matter%20produced%20by%20combustion'

NESCAUM Comments, Proposed Rule to Implement the Fine Particulate National Ambient Air Quality Standards, *January 31, 2006,*
http://rds.yahoo.com/_ylt=A0geupgUrA5FvSIAYyFXNyoA;_ylu=X3oDMTE3NG1sZWlnBGNvbG8DZQRsA1dTMQRwb3MDMgRzZWMDc3IEdnRpZANGNjY1XzEwMA--

*/SIG=12db2v44p/EXP=1158675860/**http%3a//www.nescaum.org/documents/comments060131naaqs.pdf/*

***Darkening Skies, Trends Toward Increasing Power Plant Emissions**, Clean Air Task Force, National Environmental Trust, and U.S. PIRG Education Fund, http://www.net.org/relatives/4122.pdf*

STAPPA/ALAPCO Comments on the "National Emission Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units", letter dated June 29, 2004, http://www.4cleanair.org/mercurycomments.pdf#search='Stappa%2FAlapco%20OAR20020056'

Pennsylvania's Proposed Mercury Reduction Rule, PA DEP press release, http://www.depweb.state.pa.us/mercury/site/default.asp

***Options for Controlling Mercury from Georgia Coal-Fired Power Plants: A Case for Stringent Mercury Control**, Beth Allgood, Southern Environmental Law Center, March 9, 2006, http://www.air.dnr.state.ga.us/airpermit/cair/downloads/SELC_Hg_presentation.pdf#search='Options%20for%20Controlling%20Mercury%20from%20Georgia%20CoalFired%20Power%20Plants%3A%20A%20Case%20for%20Stringent%20Mercury%20Control*

Annual Emissions Mass Caps

The proposed multi-pollutant regulation establishes annual mass emissions caps for NO_X, SO_2, and mercury for coal-fired units, and annual NO_X and SO_2 mass emissions caps for the residual oil-fired units. The annual mass caps were established to be representative of stringent emission rates associated with certain emission control technologies. The target annual emissions mass caps for coal-fired units are associated with selective catalytic reduction (SCR) for NO_X control, flue gas desulfurization (FGD) for SO_2 control, and carbon injection for mercury control. The target annual emission mass caps for residual oil-fired units are associated with the use of SCR for NO_x control and combustion of low sulfur fuel oil. These technologies have been demonstrated to be highly effective in the industry, can be retrofit to existing units, and are commercially available.

However, the proposed regulation does not require these specific control technologies be installed; other technologies may also be used to meet the proposed limits if the facility determined to implement a different or more cost effective alternative. Thus, it is the facility's choice whether to implement the suggested controls or to implement a more cost effective or different alternative that results in a lower percentage of control in reducing the applicable pollutants. Selection by the facility of an alternative may result in the facility having to remain under its emissions cap by operating the unit fewer hours or at lower outputs (reduced annual capacity factor). Historic capacity factor information, based on heat input data in the US EPA's Acid Rain Database, is shown for units subject to the proposed multi-pollutant regulation in the following table:

Unit	**Primary Fuel**	**1996 – 2005 Average**	**1996 – 2005 High Cap**

		Capacity Factor (%)	**Capacity Factor (%)**
Edge Moor 3	Coal	56	69
Edge Moor 4	Coal	61	66
Edge	Resi	26	38

Moor 5	dual Fuel Oil		
Indian River 1	Coal	47	56
Indian River 2	Coal	45	52
Indi	Coal	43	60

an River 3			
Indian River 4	Coal	36	44
McKee Run 3	Residual Fuel Oil	18	26

It can be seen from the above table that the residual oil-fired units, Edge Moor Unit 5 and McKee Run Unit 3, have historically low capacity factors relative to the coal-fired units.

Additionally, the US EPA's IPM modeling has indicated that economic forces following implementation of CAIR will result in the shutdown of virtually all residual oil-fired steam units, including Edge Moor Unit 5 and McKee Run Unit 3. Because of this and the fact that different control technologies are employed on the residual oil-fired units for SO_2 control, the residual oil-fired unit SO_2 mass caps in the proposed multi-pollutant regulation appear to accommodate present unit capacity limitations. Additional discussion is provided in the appropriate section below.

It should also be noted that during the Phase I period of the proposed multi-pollutant regulation, sources are given flexibility for compliance with the annual SO_2 and NO_X mass caps by permitting emissions averaging between units at a common facility. (Averaging is not permitted for mercury emissions during either Phase I or Phase II.) This flexibility is being provided in recognition that during Phase I of the emissions reductions, units may experience some control equipment start-up problems and require additional time for testing and optimization. The NO_X and SO_2 averaging provisions allow some compliance flexibility for individual units while ensuring that facility emissions do not exceed the expected maximums. The lack of such averaging provisions in Phase II of the proposed multi-pollutant regulation reflects the application of all appropriate controls on each of the units, reflects the solution of any technology problems encountered immediately after installation, and reflects experience gained in the operation and optimization of the installed technologies.

Determining the NO_X Emissions Annual Mass Cap

Selective catalytic reduction (SCR) is a post-combustion NO_X reduction technology in use at many locations including utility boilers in the U.S. and around the world. With SCR, flue gasses are injected with ammonia and passed over a catalyst. NO_X in the flue gas reacts with the ammonia in the presence of the catalyst to form molecular nitrogen and water. SCR is applicable to a wide range of sizes of coal, oil, and gas-fired boilers in both new and retrofit applications. For coal fired boilers, the EPA estimates that SCR is capable of 90% NO_X reductions, achieving emission rates as low as 0.06 lb/MMBTU. For oil-fired boilers, EPA estimates up to 80% NO_X reductions are possible with SCR technology.

In a presentation by MACTEC (an environmental and engineering consulting firm) to a Lake Michigan Air Director's Consortium (LADCO) air quality workshop in 2005, it was indicated that a review was performed of EPA settlement agreements for prevention of significant deterioration (PSD) cases to determine a "retrofit BACT level" for NO_X emissions. Based on this review, it was identified that a 0.10 lb/MMBTU NO_X emission rate represented such a "retrofit BACT level," and that value was utilized in developing annual NO_X emissions mass caps.

For the 5-month ozone season of 2004, the EPA Acid Rain Database identifies 67 coal fueled, wall and tangentially-fired units with average NO_X emission rates of 0.1 lb/MMBTU or less. A number of the units achieving this low average NO_X emissions

rate were located in Maryland and Pennsylvania. None of the units were located west of the Mississippi. Of the 67 units, only one was smaller, in terms of heat input capacity, than the smaller units subject to Delaware's proposed multi-pollutant regulation. Two of the 67 units were approximately the same size, in terms of heat input capacity, as the two intermediate sized units subject to Delaware's proposed multi-pollutant regulation. This indicates, in the Department's technical opinion, that low NO_X emissions rates are achievable across a wide range of unit size.

Because of the widespread success of SCR around the country and around the world at achieving high levels of NO_X reduction from utility boilers, SCR technology with a conservative NO_X emission rate of 0.1 lb/MMBTU was selected as the basis for determining annual NO_X mass emission caps for units subject to this regulation. During the multi-pollutant workgroup committee meetings there was general agreement among owners and operators and environmental group representatives that this limit is technologically feasible for the units subject to the proposed multi-pollutant regulation.

The total Delaware annual NO_X emissions mass cap was established by adding the total heat input rating (in MMBTU/hr, as identified in the EPA Acid Rain Database) for all units subject to this regulation, multiplying that value by 8670 hrs/yr, and multiplying by 0.10 lb/MMBTU.

Individual unit annual NO_X mass caps were established using a methodology similar to that used in the EPA's CAIR NO_X Model Rule, as follows:

- For each of the units subject to the proposed regulation, actual heat input data from the Acid Rain Database for the calendar years 2000 through 2004 were examined to determine the three highest heat input years for the individual unit.

- For each unit, the average of those three highest heat input years was calculated.

- The total heat input value was then calculated as the sum of all individual units' 3-year average high heat input value.

- For each individual unit, that unit's fraction of the total heat input was calculated by taking that unit's 3-year average high heat input and dividing by the total of all the units' 3-year average high heat input value.

- The individual unit allocation was calculated by multiplying the total annual allocation by the heat input fraction determined for that individual unit.

On a state-wide basis, the resulting annual NO_X mass cap represents an approximate 2% reduction below actual 2002 NO_X emissions, and an approximate 76% reduction below current "allowable" NO_X emission levels. Because the allocations are based in part on very high utilization rates, the Department does not anticipate that the mass caps will be controlling factors except at high utilization rates. Their purpose is to ensure that 1) reductions from 2002 base year emissions are guaranteed under any operating scenario,

2) the SCR based 0.1 lb/MMBTU requirement is only imposed when it is most economical to achieve (i.e., when unit utilization is expected to be high), and 3) the regulatory requirement does not limit emissions beyond current technology.

Determining the SO_2 Emissions Annual Mass Cap

Flue gas desulfurization (FGD) is a post-combustion SO_2 reduction technology in use at many locations, including utility boilers, in the U.S. and around the world. Scrubbers, in general, utilize mixtures of sorbents and water sprayed into the flue gas to react with the SO_2 and remove it from the flue gas. The resulting waste products are then removed from the flue gas stream. In some cases, these "waste products" can be used to make marketable materials. Scrubbers have been applied to a wide range in size of coal-fired units, and can be applied to either new units or a retrofit situation. There are a variety of FGD scrubber designs and technologies for coal-fired units, some with SO_2 removal efficiencies of 90% or greater. While information indicates that SO_2 scrubbers have been applied to oil-fired units overseas, no documentation could be found where SO_2 scrubbers have been applied to utility-sized, commercial residual oil-fired units in this country.

In a presentation by MACTEC (an environmental and engineering consulting firm) to a Lake Michigan Air Director's Consortium (LADCO) air quality workshop in 2005, it was indicated that a review was performed of EPA settlement agreements for prevention of significant deterioration (PSD) cases to determine a "retrofit BACT level" for SO_2 emissions. Based on this review, it was identified that a 0.15 lb/MMBTU SO_2 emission rate represented such a "retrofit BACT level."

A review of the Acid Rain Database information shows that for 2004 there were 67 coal-fueled, wall and tangentially-fired units using FGD technology that achieved an annual average SO_2 emissions rate of 0.18 lb/MMBTU or lower. There was a mix of both wet and dry FGD units achieving this level of SO_2 emission. There was also a mix of unit locations, with some units east of the Mississippi and some units west of the Mississippi. Among these 67 coal-fired units there was a wide range of unit sizes, based on rated heat input capacity, ranging from units smaller than those subject to the proposed multi-pollutant regulation to units much larger than any of the units subject to the proposed multi-pollutant regulation.

Because of the widespread success of FGD around the country on utility boilers, FGD technology with a conservative SO_2 emission rate of 0.18 lb/MMBTU was selected as the basis for determining annual SO_2 mass caps for units subject to this regulation. During the multi-pollutant workgroup committee meetings there was general agreement among owners and operators and environmental group representatives that this limit is technologically feasible for the units subject to the proposed multi-pollutant regulation.

The total annual SO_2 emissions mass cap was established by adding the total heat input rating (in MMBTU/hr, as identified in the EPA Acid Rain Database) for all units subject

to this regulation, multiplying that value by 8670 hrs/yr, and multiplying by 0.18 lb/MMBTU.

Individual unit annual SO_2 mass caps were established using a methodology similar to that used in the EPA's CAIR NO_X Model Rule, as follows:

- For each of the units subject to the proposed regulation, actual heat inputs from the Acid Rain Database for the calendar years 2000 through 2004 were examined to determine the three highest heat input years for the individual unit.

- For each unit, the average of those three highest heat input years was calculated.

- The total heat input value was then calculated as the sum of all individual units' 3-year average high heat input value.

- For each individual unit, that unit's fraction of the total heat input was calculated by taking that unit's 3-year average high heat input and dividing by the total of all the units' 3-year average high heat input value.

- The individual unit allocation was calculated by multiplying the total annual allocation by the heat input fraction determined for that individual unit.

The use of this methodology may appear to be more restrictive to the residual oil-fired units subject to the proposed multi-pollutant regulation than to the coal-fired units. This is related to the FGD scrubber technology assumed for coal-fired units being able to attain or improve upon the presumed 0.18 lb/MMBTU SO_2 emission rate. For residual oil-fired units, the commercially demonstrated (in the U.S.) best SO_2 control technology is consumption of 0.3% sulfur fuel oil, which is expected to result in SO_2 emission rates of 0.3 lb/MMBTU or lower. (Data from the Energy Information Administration (EIA) indicates that in 2005 at least 14 residual oil-fired electric generating units in Connecticut and New York fired with 0.3% sulfur fuel oil. This fuel was combusted in units sized from smaller than the smallest oil-fired unit subject to the proposed multi-pollutant regulation to a unit nearly twice the size of the largest oil-fired unit subject to the proposed multi-pollutant regulation.) The use of the low sulfur fuel oil alone would not allow the residual oil-fired units to operate at very high capacity factors. However, as discussed earlier, Delaware's residual oil-fired units have historically low capacity factors relative to the coal-fired units, and the EPA projects the capacity factors for residual oil units will in fact decrease under CAIR.

If the residual oil-fired units combust a fuel with a 0.5% sulfur content, the anticipated SO_2 emission rate would be 0.5 lb/MMBTU or lower. With a SO_2 emission rate of 0.5 lb/MMBTU, based on the proposed multi-pollutant regulation's SO_2 annual mass caps, Edge Moor Unit 5's capacity factor (heat input basis) would be restricted to approximately 25% and McKee Run Unit 3's capacity factor (heat input basis) would be restricted to 17%. Over the last 10 years, Edge Moor Unit 5's average capacity factor

(heat input basis) has been 26% and McKee Run Unit 3's capacity factor (heat input basis) has been 18%.

If the residual oil-fired units combust a fuel with a 0.3% sulfur content, the anticipated SO_2 emission rate would be 0.3 lb/MMBTU or lower. With a SO_2 emission rate of 0.3 lb/MMBTU, based on the proposed multi-pollutant regulation's SO_2 annual mass caps, Edge Moor Unit 5's capacity factor (heat input basis) would be restricted to approximately 39% and McKee Run Unit 3's capacity factor (heat input basis) would be restricted to 28%. Over the last 10 years, Edge Moor Unit 5's highest annual capacity factor (heat input basis) has been 38%, and McKee Run Unit 3's highest annual capacity factor (heat input basis) has been 26%. Again, as indicated above, capacity factors for the oil-fired units are projected to remain low, or decrease, based on US EPA analysis using the cost-based IPM computer model. Nonetheless, the rule would accommodate historic usage of the units as discussed, while endeavoring to reduce emissions of applicable air pollutants and associated negative health benefits.

On a state-wide basis, the resulting annual SO_2 mass cap represents an approximate 54% reduction below actual 2002 SO_2 emissions, and an approximate 87% reduction below current "allowable" SO_2 emission levels. Similar to the annual NO_X caps, these caps are not anticipated to be controlling factors except at high utilization rates. Their purpose is to ensure that 1) reductions from 2002 base year emissions are guaranteed under any operating scenario, 2) the FGD based 0.18 lb/MMBTU requirement is only imposed when it is most economical to achieve (i.e., when unit utilization is expected to be high), and 3) the regulatory requirement does not limit emissions beyond current technology

Determining the Mercury Emissions Annual Mass Caps

The total statewide mercury mass caps for Delaware's coal-fired electric generating units were identified in the EPA's Clean Air Mercury Rule (CAMR). CAMR lists annual mercury caps of 0.072 ton for Phase I, and 0.028 ton for Phase II.

For the units subject to this regulation, the total annual mercury emissions mass cap for the period 2009 through 2012 was determined from the CAMR Phase I cap, reduced by a 5% set-aside. The total annual mercury mass cap for the period 2013 and beyond was determined as the CAMR Phase II cap, reduced by a 3% set-aside. These set-aside reductions are consistent with the CAMR model rule methodology. The mercury set-asides would provide Delaware some flexibility under the CAMR requirements for dealing with mercury emissions from any new unit sited in Delaware in the future. For each of Phase I and Phase II, individual unit annual mercury mass caps were established using a methodology similar to that used in the EPA's CAIR NO_X Model Rule using the appropriate Phase total mercury mass cap, as follows:

- For each of the units subject to the proposed regulation, actual heat inputs from the Acid Rain Database for the calendar years 2000 through 2004 were examined to determine the three highest heat input years for the individual unit.

- For each unit, the average of those three highest heat input years was calculated.

- The total heat input value was then calculated as the sum of all individual units' 3-year average high heat input value.

- For each individual unit, that unit's fraction of the total heat input was calculated by taking that unit's 3-year average high heat input and dividing by the total of all the units' 3-year average high heat input value.

- The individual unit allocation was calculated by multiplying the total annual allocation by the heat input fraction determined for that individual unit.

Because there has been no requirement to do so, there is no actual long term mercury emissions data for the coal-fired units subject to this regulation. Based on industry average mercury emissions information (3.3 lb/TBTU), the Phase I mercury emissions cap represents an approximate 4 lb/yr, or 3%, reduction from estimated 2002 mercury emissions. Again based on the estimated 3.3 lb/TBTU rate, the Phase II mercury emissions cap represents an estimated 90 lb/yr, or 64%, reduction from the estimated 2002 mercury emissions.

NOx Annual Emissions	**Phase I (tons)**	**Phase II (tons)**
2002 Actual	8143	8143
CAIR Allocation	3341 (2	2842 (2

	0 0 9)	0 1 5)
IP M Pre dict ed	1 0 6 4 1	1 0 9 8 4
Pro pos ed Cap	7 9 4 2 (2 0 0 9)	7 9 4 2 (2 0 0 9)

SO_2 Annual Emissions	**Phase I (tons)**	**Phase II (tons)**
2 0 0 2	3 1 1 8	3 1 1 8

Actual	4	4
CAIR Allocation	21638 (20100)	151466 (20155)
IPM Predicted	45132	46869
Proposed C	14295 (200	14295 (200

a p	9)	9)

Mercury Annual Emissions	**Phase I (lb)**	**Phase II (lb)**
2002 Estimated	103	103
CAMR Allocation	138 (2010)	53 (2018)
IPM Predicted	233	279
Proposed Cap	137 (2009)	51 (2013)

***References**:*

***Regulating Mercury from Power Plants: A Model Rule for States and Localities**, STAPPA/ALAPCO, November 2005:*
http://www.4cleanair.org/FinalMercuryModelRule-111405.pdf

US EPA Clean Air Markets – Progress and Results, Acid Rain Program:
http://www.epa.gov/airmarkets/emissions/prelimarp/index.html

***Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options**, STAPPA/ALAPCO, March 2006: http://www.4cleanair.org/PM25Menu-Final.pdf*

***Standalone Documentation for EPA Base Case 2004 (V.2.1.9) Using the Integrated Planning Model**, US EPA, EPA 430-R-05-011, September 2005,*
http://www.epa.gov/airmarkets/epa-ipm/bc1intro.pdf

***Performance and Cost of Mercury and Multipollutant Emission Control Technology Applications on Electric Utility Boilers**, US EPA, EPA-600/R-03-110, October 2003,*
http://www.epa.gov/appcdwww/aptb/EPA600R03110.pdf

Letter, David Foerter, Institute of Clean Air Companies to Michael Leavitt, Administrator US EPA, Docket ID No. OAR-2002-0076, July 15, 2004,
http://www.icac.com/files/public/bartcomments071504.pdf#search='David%20Foerter%20Michael%20Leavitt'

***State of Maryland – Control Technology Information Briefing**, Institute of Clean Air Companies presentation to Maryland Legislature, February 7, 2006,*
http://www.icac.com/files/public/Maryland_House_Testimony_020706.pdf

***System Overview: ECO Technology (Electro-Catalytic Oxidation)**, Powerspan Corp:*
http://www.powerspan.com/technology/scrubber_overview.shtml

***Regional Air Quality Workshop, Day 1, Overview of Candidate Point Source Control Measures for SO2 and NOx**, Presented by Edward Sabo, MACTEC Federal Programs, June 28, 2005,*
http://www.ladco.org/reports/rpo/Regional%20Air%20Quality/June28_2005/June-Workshop/MACTEC_Day1_Overview.pdf#search='regional%20air%20quality%20workshop%20mactec'

***Interim White Paper – Midwest RPO Candidate Control Measures, Source Category: Electric Generating Units**, January 14, 2005,*
http://www.bracewellgiuliani.com/blog/energylegalblog/uploads/mrpo_white_paper.pdf#search='retrofit%20NOx%20bact'

*Memorandum, **Cost-Effective Nitrogen Oxides (NOx) Reasonably Available Control Technology (RACT)**, From D. Kent Berry, Acting Director Air Quality Management Division, US EPA, March 16, 1994,*
http://www.epa.gov/ttn/oarpg/t1/memoranda/costcon.pdf

***Availability of Mercury Control Technology**, Presentation to Pennsylvania Mercury Rule Workgroup Meeting, by David Foerter, Institute of Clean Air Companies, November 18, 2005,*
http://www.dep.state.pa.us/dep/DEPUTATE/AIRWASTE/AQ/regs/docs/Foerter_Presentation_111805.pdf#search=%22coal%20scr%20months%22

***EPA Orders Air Quality Improvements at Mystic Station Power Plant In Everett**, US EPA Press Release, March 6, 2002,*
http://www.epa.gov/region1/pr/2002/mar/020301.html

Short Term Emission Rate Limitations

One of the goals of the proposed regulation is to help Delaware achieve attainment of the National Ambient Air Quality Standard (NAAQS) for ground level ozone and fine particulate matter in all three of Delaware's counties; and to help maintain compliance with those NAAQS once attainment is reached. In addition, the proposed regulation will help Delaware be designated as attainment with the new 35 ug/m^3 24-hour fine particulate matter standard promulgated by the EPA. Emissions limits must be paired with appropriate averaging times to ensure protection of the standards.

The $PM_{2.5}$ and ozone NAAQS have short term components (24-hr for $PM_{2.5}$ and 8-hr for ozone). Long term emissions limits, such as annual mass caps that ensure long term emission levels do not exceed acceptable values, do not ensure that emissions from affected sources are limited to values that will not compromise the short term NAAQS. Absent a short-term enforceable emissions limitation, actual or design potential-to-emit of the subject unit(s) is the sole limiting factor over the same time period. In the Departments technical opinion, averaging times should, in most cases, be equal to or shorter than the time frame associated with the standard.

As stated in an earlier section above, the target annual emissions mass caps were established based on the emission control capabilities of selective catalytic reduction (SCR) for NO_X control, flue gas desulfurization (FGD) for SO_2 control, and carbon injection for mercury control. These technologies have been demonstrated to be highly effective, can be retrofit to existing units, and are commercially available. However, it is also recognized that day-to-day variations can have significant impact on the ability to attain stringent emission rate limits during any given short duration time frame. Unit output levels, amount of load following, fuel quality variability, and the need to perform routine maintenance can have an effect on the achievable emission rates over a short duration. Short term emission rate limits must be established at levels to ensure short term environmental goals are met while recognizing that long term emission rate values may not be attainable at any given specific time. In recognition of the potential variability, the proposed multi-pollutant regulation includes short term emission rates that are protective of the short term NAAQS but are less stringent than that which would be equivalent to the long term mass cap. Specific rate limits are discussed in the appropriate sections below.

With regards to mercury emissions from the coal-fired units, the proposed multi-pollutant regulation provides short term emission rate flexibility in Phase I and Phase II by allowing a unit to meet a specified emission rate or a percentage reduction from baseline testing conducted on that particular unit. This should help eliminate the problems that could occur due to variability in unit design and/or fuel source.

It is also recognized that during Phase I of the emissions reductions, units may experience some control equipment start-up problems and require additional time for testing and optimization. For this reason, the Phase I NO_X and SO_2 short term emission rate

provisions allow for emission rate averaging for the units at a single, multi-unit facility. (Averaging of mercury emissions is not permitted in either Phase I or Phase II of the proposed multi-pollutant regulation.) The NO_X and SO_2 averaging provisions allow some compliance flexibility for individual units while ensuring that facility emissions do not exceed the expected maximums. The lack of such averaging provisions in Phase II reflects the application of all appropriate controls on each of the units (a stated goal of this rulemaking process), reflects the solution of any technology problems encountered immediately after installation, and reflects experience gained in the operation and optimization of the installed technologies.

The application of short term emission rate limits is also significant for the residual oil-fired units subject to the proposed regulation. Because of the relatively high cost of fuel for these units, they will typically operate more during peak electrical use times such as hot summer days when electrical demand and costs are elevated. Such days also tend to be those with the greatest air quality problems caused by pollutants covered by this proposed regulation. Without adequate controls on these units, their emissions will substantially increase the pollutants emitted and contribute to air quality problems and public health concerns.

Short Term NO_X Emission Rates

In the proposed regulation, short term NO_X emission rate limits are included, and are being implemented in a phased manner. For Phase I, January 1, 2009 through December 31, 2011, the short term NO_X emission rate limit is 0.15 lb/MMBTU of heat input on a rolling 24-hr basis. For Phase II, January 1, 2012 and beyond, the short term NO_X emission rate limit is 0.125 lb/MMBTU of heat input on a rolling 24-hr basis. These short term values are both greater than the 0.1 lb/MMBTU rate used as the basis for the determination of the annual NO_X mass emissions caps.

In a presentation by MACTEC (an environmental and engineering consulting firm) to a Lake Michigan Air Director's Consortium (LADCO) air quality workshop in 2005, it was indicated that a review was performed of EPA settlement agreements for prevention of significant deterioration (PSD) cases to determine a "retrofit BACT level" for NOx emissions. Based on this review, it was identified that a 0.10 lb/MMBTU NOx emission rate represented such a "retrofit BACT level". The presentation also identified that it was appropriate to apply an interim NOx emission rate limit, 0.15 lb/MMBTU, in determining the NOx annual mass caps for the first phase of phase of the emissions reduction program.

The proposed regulation's NO_X emission rates of 0.15 lb/MMBTU and 0.125 lb/MMBTU were those used by the EPA in establishing the regionwide, annual CAIR NO_X budgets. Those values were also used in calculating individual state-specific annual CAIR NO_X budgets, and then adjusted for fuel type (multipliers of 1.0 for coal, 0.6 for oil, and 0.4 for gas). In the CAIR preamble, EPA indicates that the 0.15 lb/MMBTU and

0.125 lb/MMBTU phased in NO_X limitations correspond to costs that meet the highly cost-effective control criteria.

For the coal units, relative to NO_X RACT (described as "allowable" by some of the sources subject to this proposed regulation), the emission rate limits of 0.15 lb/MMBTU and 0.125 lb/MMBTU represent an approximate 60% and 70% reduction, respectively.

The Phase I short term NO_X emissions rate limit of 0.15 lb/MMBTU also corresponds to the emissions rate basis used for the EPA's NO_X SIP Call, a program promulgated in 1997. The NO_X SIP Call is a regional ozone season cap-and-trade NO_X control program that became effective, including in Delaware, during the 2003 ozone season (May 1 through September 30 of each year). For the units subject to Delaware's proposed multi-pollutant regulation, the NO_X SIP Call established seasonal mass caps equivalent to a baseline heat input multiplied by a NO_X emission rate of 0.15 lb/MMBTU.

The proposed multi-pollutant regulation also allows averaging of the NO_X emission rates during Phase I, on a heat input basis, of the units at the same facility subject to the proposed regulation. This provides additional flexibility for attaining compliance with the Phase I NO_X emission rate limit.

The Phase II NO_X emissions rate limitation of the proposed regulation is 0.125 lb/MMBTU for each unit (no averaging), an approximate 17% reduction below the Phase I value. This value reflects the view that Phase II should reflect the completion of any staged NO_X reduction installation occurring during Phase I, reflect the solution of any technology problems encountered immediately after installation, and reflect experience gained in the operation and optimization of the installed technologies.

Short Term SO_2 Emission Rates

In the proposed regulation, short term SO_2 emission rate limits are included, and are being implemented in a phased manner. For Phase I, January 1, 2009 through December 31, 2011 the short term SO_2 emission rate limit is 0.37 lb/MMBTU of heat input on a rolling 24-hr basis. For Phase II, January 1, 2012 and beyond, the short term SO_2 emission rate limit is 0.26 lb/MMBTU of heat input on a rolling 24-hr basis. These short term values are both greater than the 0.18 lb/MMBTU rate used as the basis for the determination of the annual NO_X mass emissions caps.

In a presentation by MACTEC (an environmental and engineering consulting firm) to a Lake Michigan Air Director's Consortium (LADCO) air quality workshop in 2005, it was indicated that a review was performed of EPA settlement agreements for prevention of significant deterioration (PSD) cases to determine a "retrofit BACT level" for SO_2 emissions. Based on this review, it was identified that a 0.15 lb/MMBTU SO_2 emission rate represented such a "retrofit BACT level". The presentation also identified that it was appropriate to apply an interim SO_2 emission rate limit, 0.36 lb/MMBTU, in determining the NO_X annual mass caps for the first phase of phase of the emissions reduction

program. These same emission rate values were also adopted by STAPPA/ALAPCO in determining their proposed emission caps.

The proposed regulation's SO_2 emission rates of 0.37 lb/MMBTU and 0.26 lb/MMBTU were identified by the EPA, through the OTC multi-pollutant workgroup, as the expected average regional emission rates for CAIR Phase I and Phase II, respectively. These values were also utilized by Maryland in the calculation of unit specific annual SO_2 mass caps in that state's proposed clean power regulation.

For three of the coal-fired units, the 0.37 lb/MMBTU and 0.26 lb/MMBTU values represent SO_2 emissions rate reductions of approximately 65% and 75% respectively from 2005 values. For the other three coal-fired units, the 0.37 lb/MMBTU and 0.26 lb/MMBTU values represent SO_2 emissions rate reductions of approximately 70% and 80% respectively from 2005 values. These values are well within the capability of a number of existing, widely available SO_2 emission control technologies.

The proposed multi-pollutant regulation also allows averaging of the SO_2 emission rates during Phase I, on a heat input basis, of the units at the same facility subject to the proposed regulation. This provides additional flexibility for attaining compliance with the Phase I SO_2 emission rate limit.

Short Term Mercury Emission Rates

In the proposed regulation, short term mercury emission rate limits are included, and are being implemented in a phased manner. For Phase I, January 1, 2009 through December 31, 2012 the short term mercury emission rate limit is 1.0 lb/TBTU, or 80% capture and control of inlet mercury. For Phase II, January 1, 2013 and beyond, the short term mercury emission rate limit is 0.6 lb/TBTU, or 90% capture of inlet mercury.

Industry literature suggests that these mercury emissions rate limits are achievable with demonstrated, commercially available mercury emissions reduction technologies.

Guidance for the establishment of these mercury emissions rate limitations was provided by STAPPA/ALAPCO's mercury emissions control model rule. A number of states are proposing regulations to impose similarly stringent mercury emissions rate limits on coal-fired electric generating units.

As there has been no previous requirement to monitor mercury emissions from coal-fired electric generating units, there is no unit or state specific information to estimate the reduction percentages represented by these mercury emission rate limits. Based on an industry average value of 3.3 lb/TBTU, the 1.0 lb/TBTU Phase I limit represents a rate reduction of approximately 70%. Based on that same industry average value, the 0.6 lb/TBTU Phase II limit represents a rate reduction of approximately 82%.

***References**:*

***State Mercury Programs for Utilities**, STAPPA/ALAPCO, June 27, 2006, http://www.4cleanair.org/StatePrograms.pdf#search='State%20Mercury%20Programs%20for%20Utilities'*

***STAPPA and ALAPCO Model Mercury Emissions Control Rule for Coal-Fired Electric Generating Units**, STAPPA/ALAPCO, http://www.4cleanair.org/FinalMercuryModelRule-111405.pdf#search='STAPPA%20and%20ALAPCO%20Model%20Mercury%20Emissions%20Control%20Rule%20for%20CoalFired%20Electric%20Generating%20Units'*

***Recommendations in support of primary fine particle National Ambient Air Quality Standards to protect northeastern populations**, NESCAUM, July 1, 2005, nescaum.org/documents/final-nescaum-pm2-5-standards-white-paper.pdf*

***Regional Air Quality Workshop, Day 1, Overview of Candidate Point Source Control Measures for SO2 and NOx**, Presented by Edward Sabo, MACTEC Federal Programs, June 28, 2005, http://www.ladco.org/reports/rpo/Regional%20Air%20Quality/June28_2005/June-Workshop/MACTEC_Day1_Overview.pdf#search='regional%20air%20quality%20workshop%20mactec'*

***Interim White Paper – Midwest RPO Candidate Control Measures, Source Category: Electric Generating Units**, January 14, 2005, http://www.bracewellgiuliani.com/blog/energylegalblog/uploads/mrpo_white_paper.pdf#search='retrofit%20NOx%20bact'*

*Memorandum, **Cost-Effective Nitrogen Oxides (NOx) Reasonably Available Control Technology (RACT)**, From D. Kent Berry, Acting Director Air Quality Management Division, US EPA, March 16, 1994, http://www.epa.gov/ttn/oarpg/t1/memoranda/costcon.pdf*

***Availability of Mercury Control Technology**, Presentation to Pennsylvania Mercury Rule Workgroup Meeting, by David Foerter, Institute of Clean Air Companies, November 18, 2005, http://www.dep.state.pa.us/dep/DEPUTATE/AIRWASTE/AQ/regs/docs/Foerter_Presentation_111805.pdf#search=%22coal%20scr%20months%22*

Emissions Monitoring

The proposed multi-pollutant regulation requires compliance demonstration with the emissions limitations of the proposed multi-pollutant regulation through the use of approved continuous emissions monitoring systems (CEMS). The proposed multi-pollutant regulations requires that these CEMS must be installed, certified, calibrated, operated, and maintained in accordance with US EPA requirements.

For NO_X and SO_2 emissions, the proposed multi-pollutant regulation specifies the CEMS must comply with all 40 CFR Part 75 (including monitoring, recordkeeping, QA/QC, and reporting) requirements. These are the same requirements that are necessary for compliance with the US EPA's CAIR program (and are specified in the CAIR), for which each of the units subject to the multi-pollutant regulation are also subject. The multi-pollutant regulation has "borrowed" these requirements from the US EPA's CAIR program. By maintaining this consistency between monitoring requirements, data reporting duplication can be reduced or eliminated and there will be greater assurance of data accuracy. Further, the US EPA's database is available for both Department and public access.

For monitoring mercury emissions, the proposed multi-pollutant regulation specifies the used of CEMS meeting the requirements of 40 CFR Part 75 and 40 CFR Part 60. These specific monitoring requirements are the same as those specified for the US EPA's CAMR program. In order for Delaware to elect not to participate in the CAMR cap-and-trade program, it must demonstrate to the US EPA that is has a program that monitors and controls mercury emissions from subject units to a level at or below the CAMR specified state cap. In order to demonstrate compliance with this US EPA requirement, it is necessary to monitor mercury emissions using CEMS equivalent to the CAMR program requirements. By specifying the same CEMS requirements as CAMR, Delaware is taking a step to ensure the US EPA's acceptance of the multi-pollutant regulation's mercury emissions control provisions. Additionally, by maintaining consistency between monitoring requirements, data reporting duplication can be reduced or eliminated and there will be greater assurance of data accuracy. The US EPA's database will be available for both Department and public access.

References:

Rule To Reduce interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule); Revisions to Acid Rain Program; Revisions to the NOx SIP Call; Final Rule*, US EPA, Federal Register, May 12, 2005, http://a257.g.akamaitech.net/7/257/2422/01jan20051800/edocket.access.gpo.gov/2005/pdf/05-5723.pdf*

Revision of December 2000 Clean Air Act Section 112 (n) Finding regarding Electric Utility Steam Generating Units; and Standards of Performance for New and Existing Electric Utility Steam Generating Units: Reconsideration*, US EPA, May 31, 2006,* *http://www.epa.gov/air/mercuryrule/pdfs/camr_recon_fr_final_053106.pdf*

Availability of Mercury Control Technology*, Presentation to Pennsylvania Mercury Rule Workgroup Meeting, by David Foerter, Institute of Clean Air Companies, November 18, 2005,*
http://www.dep.state.pa.us/dep/DEPUTATE/AIRWASTE/AQ/regs/docs/Foerter_Presentation_111805.pdf#search=%22coal%20scr%20months%22

Implementation Timing

The proposed multi-pollutant regulation establishes both short term emission rate limits and annual emission mass emission caps. The proposed multi-pollutant regulation's short term rates represent a phased in approach similar, but in a somewhat accelerated manner, to the phased approach for mass caps established under the federal CAIR and CAMR programs. The CAIR and CAMR programs do not establish any short term emissions rate limitations, only the long term annual mass caps. However, the CAIR and CAMR programs implement the annual caps using a phased in approach in a fashion similar to that utilized for the proposed multi-pollutant regulation, and would require units to reduce their emission rates to reflect both the interim (Phase I) and final (Phase II) annual emissions caps (assuming equal or higher unit capacity factors).

The utilization of phased in short term emission rates was selected to begin achieving some significant emission reductions in a relatively short period of time while still allowing the facilities flexibility in meeting the overall reduction goals. Flexibility will be gained during Phase I through the proposed multi-pollutant regulation's adoption of higher overall emission rate limitations (relative to the Phase II rate limitations) and also permitting units at a common facility to average their emission rates to achieve compliance. The proposed regulation does not specify a compliance methodology, only emission rate limitations. This allows subject facilities the flexibility to establish a compliance method that best suits the facility, and could include over-compliance on a unit(s) and averaging, interim controls installation, fuel switching, changes in operating schedules, etc.

The proposed multi-pollutant regulation's Phase I emission reductions will provide a period of time of significant emissions reductions to support the state in attaining emissions reduction required for its 8-hr ozone Reasonable Further Progress Plan (2010 demonstration date), and also support attaining the 8-hr ozone and fine particulate NAAQS. Meeting these goals will help Delaware avoid sanctions and penalties associated with non-compliance with the Clean Air Act provisions. Additionally, the Phase I emissions reductions would be expected to provide health benefits associated with improved air quality, including reductions in premature deaths, hospital visits, asthma attacks, etc.

The proposed multi-pollutant regulation's annual NO_X and SO_2 mass caps are similar to the CAIR Phase II in magnitude but are not phased in. The proposed multi-pollutant regulation NO_X and SO_2 mass caps become effective during the first compliance year of the multi-pollutant regulation, which corresponds more closely to the CAIR Phase I period. For SO_2, this start date is also one year earlier than the CAIR program (2009 vs. 2010).

The proposed multi-pollutant regulation's annual mercury mass caps are phased in and of similar magnitude to the CAMR program. The multi-pollutant regulation Phase I start date is one year earlier than the CAMR Phase I start date (2009 vs. 2010). The proposed

multi-pollutant regulation's mercury Phase II start date is two years earlier than the CAMR program's Phase II (2013 vs. 2015).

The following tables identify the respective emission limit compliance dates:

Program/Pollutant	**Phase I Date**	**Phase I Limit**
CAIR/NO_X (mass cap)	Jan. 1, 2009	33411 tons/yr
CAIR/SO_2 (mass cap)	Jan. 1, 2010	21638 tons/yr
CA	J	1

MR/ Hg (mass cap)	an. 1, 2010	38 lb/yr
Multi- P/NO$_X$ (mass cap)	Jan. 1, 2009	7942 tons/yr
Multi- P/SO$_2$ (mass cap)	Jan. 1, 2009	14295 tons/yr
Multi- P/Hg (mass cap)	Jan. 1, 2	137 lb/yr

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Multi-P NO_X (rate)	Jan. 1, 2009	0.15 lb/MMBTU
Multi-P SO_2 (rate)	Jan. 1, 2009	0.37 lb/MMBTU
Multi-P/Hg (rate)	Jan. 1, 2009	1.0 lb/TBTU or 8

		0% reduction

Program/Pollutant	**Phase II Date**	**Phase II Limit**
CAIR/NO_X (mass cap)	Jan. 1, 2015	2842 tons/yr
CAIR/SO_2 (mass	Jan.	15146

cap)	1, 2015	tons/yr
CAMR/Hg (mass cap)	Jan. 1, 2018	53 lb/yr
Multi-P/NO_X (mass cap)	Jan. 1, 2009	7942 tons/yr
Multi-P/SO_2 (mass cap)	Jan. 1, 2009	14295 tons/yr

Multi-P/Hg (mass cap)	Jan. 1, 2013	51 lb/yr
Multi-P/NO_X (rate)	Jan. 1, 2012	0.125 lb/MMBTU
Multi-P/SO_2 (rate)	Jan. 1, 2012	0.26 lb/MMBTU
Multi-P/Hg (rate)	Jan. 1	0.6 lb

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Accelerated implementation of the emissions annual mass cap limitations will accelerate the health benefits associated with the emissions reductions, helping to reduce premature deaths, hospital visits, asthma attacks, etc.

Another reason for acceleration of emissions mass cap reductions in the early phase is to ensure some period of time of significant emissions reductions to support the rate of progress plan and attainment dates for the 8-hr ozone and fine particulate standards. Meeting these goals should help Delaware avoid the sanctions and penalties associated with non-compliance with Clean Air Act provisions.

References:

Ozone Transport Commission Comments on Supplemental Proposal Published June 10, 2004 in Federal Register Volume 59, OTC letter dated July 26, 2004, *http://bronze.nescaum.org/committees/attainment/comments040726iaqr.pdf* *and* *http://bronze.nescaum.org/committees/attainment/comments040726iaqr-attachA.pdf#search='Ozone%20Transport%20Commission%20OAR20030053'*

STAPPA/ALAPCO Comments on Supplemental Proposal Published June 10, 2004 in Federal Register Volume 59, STAPPA/ALAPCO letter dated July 21, 2004, *http://www.4cleanair.org/Supplementalcomments-ltrhd.pdf*

STAPPA/ALAPCO Comments to Docket ID No. OAR-2002-0056 regarding 70 Federal Register 62200 and 62213, dated October 28, 2005, STAPPA/ALAPCO letter dated December 19, 2005, http://www.4cleanair.org/121905reconsiderationcomments.pdf

Docket #OAR 2003-0053 Supplemental Notice for the Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule), NECAUM letter dated July 26, 2004, www.nescaum.org/documents/comments040726iaqr.pdf

***First Evaluation of the Retrofitted SCR at the Coal Fired Somerset Generating Station**, Robison et al, Hitachi America, http://www.hitachi.us/supportingdocs/forbus/powerindustrial/EP2001Paper.pdf#search='first%20evaluation%20of%20the%20retrofitted'*

Estimated Costs of Emissions Controls

It is difficult to determine the precise cost for affected facilities to comply with this proposed regulation. Site and unit-specific requirements and variables can greatly impact the cost and installation of pollution control equipment necessary to comply with the requirements of the proposed regulation. Also, assumptions concerning equipment cost factors, compliance strategies, fuels, and plant capacity factor and unit utilization all impact the estimated capital costs.

The proposed regulation does not impose a compliance strategy nor does it require a specific pollution control equipment selection. However, for the purposes of cost estimation, it is assumed that compliance with the annual mass caps established in the proposed regulation for NO_X, SO_2, and mercury will require the installation and operation of the most effective commercially available and proven pollution control technologies in order to retain the ability to operate the units at annual capacity factors of 100%. [Previous comments from Delaware's affected utility unit owners and operators have indicated that the ability to retain the option of 100% annual capacity factor operation is a most important consideration.] The emissions control technologies assumed for this estimation are: selective catalytic reduction (SCR) for NO_X control, flue gas desulfurization (FGD) scrubbers for SO_2 control, and carbon injection for mercury emissions control. However, even among these specific classes of emissions control technologies, there are variations in the selection and design of the controls that affect the cost and efficiency of the controls.

Estimated Capital Cost

The following are the Department's conservative estimates of the total capital cost of emissions controls for NO_X, SO_2, and mercury for the fleet of units affected by the proposed regulations:

NO_X - The annual NO_X mass emissions cap proposed in this regulation is based on an annual average NO_X emissions rate of 0.1 lb/MMBTU. As previously discussed, the 0.10 lb/MMBTU was selected as it represents an emission rate that can be achieved using selective catalytic reduction (SCR), a technology with demonstrated emissions reduction capability in a retrofit application. For the purpose of cost estimation, it was conservatively assumed that all of the coal and residual oil-fired units subject to this regulation would require the installation of SCR's to maintain the ability to operate with 100% annual capacity factors. The estimated capital cost to install SCR's for all of the units subject to this regulation is $161.250 million. Information and data to calculate this estimate was taken from the US EPA document **Documentation Summary for EPA Base Case 2004 (V.2.1.9) Using the Integrated Planning Model**, dated October 2004, and the Acid Rain Database.

SO_2 - The annual SO_2 mass emissions cap proposed in this regulation is based on an average SO_2 emissions rate of 0.18 lb/MMBTU. The 0.18 lb/MMBTU SO_2 emission rate was selected as it represents an emission rate that can be achieved using flue gas desulfurization (scrubber) technology. Scrubber technology has been widely demonstrated to have significant emissions reduction capability in a retrofit application. For the purpose of cost estimation, it was conservatively assumed that all of the coal fired units subject to this regulation would install scrubbers to maintain the ability to operate with high annual capacity factors. The estimated capital cost to install scrubbers on all of the coal-fired units subject to this regulation is $376.952 million. Information and data to calculate this estimate was taken from the USPEA document **Standalone Documentation for EPA Baseline 2004 (V.2.1.9) Using the Integrated Planning Model**, dated September 2004, and the Acid Rain Database.

Mercury - EPA guidance and industry literature indicate that there may be considerable co-benefits of SCR and scrubber to also reduce mercury emissions from coal-fired units. Information indicates that the use of SCR, scrubbers, and electrostatic precipitators (precipitators are already installed on the coal units subject to this regulation to meet the requirements of other emissions standards under the Clean air Act) achieve mercury reductions to the level that additional, stand-alone mercury emissions controls may not be needed to attain the mercury emissions limits proposed in this regulation. However, for cost-estimation purposes, it was conservatively assumed that each coal-fired unit would require the installation of a stand-alone carbon injection system with fabric filter to attain the mercury emissions limitation even though all of the units are assumed to install SCR and FGD in conjunction with existing ESP's. Carbon injection systems with fabric filters have been demonstrated as stand-alone systems to have the capability of attaining the level of mercury reductions required in this proposed regulation. It was estimated that the cost to install carbon injection systems with fabric filters on all of the coal-fired units subject to this regulation is $56.244 million. Information and data to calculate this estimate was taken from the US EPA document **Research and Development, Performance and Cost of Mercury and Multipollutant Emission Control Technology Applications on Electric Utility Boilers**, dated October 2003, and the Acid Rain Database.

Based on the above information and assumptions, the total estimated capital cost for compliance with the requirements of the proposed regulation is conservatively estimated at $595 million. This estimate does not include any financing cost.

If all of the units subject to this regulation are assumed to operate at a 70% capacity factor, it is estimated that the capital costs associated with this regulation would result in an increase in average generating costs of approximately $6/MWh. If the oil-fired units (Edge Moor Unit 5 and McKee Run Unit 3) are operated with a more realistic 20% capacity factor and the coal-fired units maintain a 70% capacity factor, it is estimated that the capital costs associated with regulation would result in an increase in average generating costs of $8.2/MHh. Information from the Acid Rain Database indicates that for the 5-yr period of 2000 through 2004, the average capacity factor (based on heat

input) for Edge Moor Unit 5 was 21% and the average capacity factor (based on heat input) for McKee Run Unit 3 was 20%.

This estimate for capital cost is somewhat consistent with information presented during a workgroup meeting by the representative of the Center for Energy and Economic Development (CEED), a coal user/supplier trade organization. In the presentation it was estimated that that the capital cost of SO_2 scrubbers on the coal units would be nearly $350 million, the capital costs of SCRs on the coal units would be nearly $150 million, and the cost of mercury controls for the coal units would range from $25 million to $75 million. The total of the costs presented in the CEED presentation would therefore range between nearly $525 million and nearly $575 million.

In its presentation to the multi-pollutant workgroup committee, the City of Dover estimated the capital cost for retrofitting SCR on McKee Run Unit 3 at $10 million, and the O&M costs for the SCR system was estimated to be $150,000 per year. It was also presented that it was estimated that the premium cost of the lower sulfur fuel oil was 10% above current costs.

During their presentations to the multi-pollutant workgroup committee, both Conectiv and NRG discussed the costs to reduce NO_x, SO_2, and mercury emissions from their facilities. Their estimates were consistent with the Departments, however, they did not include those cost estimates in the information that was submitted to DNREC which was to be made available to the public by posting the information on the multi-pollutant regulation web page.

Estimated Operations and Maintenance (O&M) Cost

In addition to the capital costs associated with the purchase and installation of the specific pollution control equipment discussed above, there will be recurring fixed and variable costs associated with the operation and maintenance of that equipment. These costs would include the costs of consumable chemicals and reagents, manpower for operation, manpower for maintenance, water usage, waste disposal, increased electrical consumption to operate the equipment, etc. Additionally, for residual oil-fired units, variable costs would include the premium pricing of 0.5% sulfur fuel oil relative to the currently permissible 1.0% sulfur fuel oil.

NO_X - Assuming 70% capacity factor for all of the units subject to this regulation, the estimated O&M costs for compliance with the NO_X emissions limitations of this regulation are $8.053 million per year. However, the use of a 70% capacity factor for the oil-fired units is unrealistic based on historic operating levels. For example, if the oil-unit capacity factor is reduced to 20% and the coal units' capacity factor is left at 70%, the estimated total annual O&M cost for NO_X control is $4.823 million per year.

SO_2 - Assuming 70% capacity factor for all of the units subject to the proposed regulation, the estimated O&M (and fuel oil premium) costs for compliance with the SO_2

emissions limitations of this regulation are $67.518 million per year. This cost is strongly driven by the premium cost of the 0.5% sulfur fuel oil for the residual oil-fired units and the high estimated capacity factor of 70% for those units. For example, if the oil-fired unit capacity factor is reduced to a more realistic 20%, and the coal units' capacity factor is left at 70%, the estimated total annual O&M (with the same fuel premium) cost for SO_2 control is $36.4 million per year.

Mercury – Assuming 70% capacity factor for all of the coal-fired units subject to the proposed regulation, the estimated O&M cost for compliance with the mercury emissions limitation of the proposed regulation is $10.466 million per year.

From the above values, the total estimated O&M costs for compliance with the emissions limitations of this regulation is $86.037 million per year, assuming a 70% capacity factor for all of the units subject to this proposed regulation. If a 70% capacity factor is used for the coal-fired units and a 20% capacity factor is assumed for the oil-fired units, the estimated annual O&M cost is $51.689 million per year.

Assuming a 70% capacity factor for all of the units, the annual increase in O&M cost results in an approximate increase in the average cost of generation of $8.80/MWhr. Assuming a 70% capacity factor for coal-fired units and 20% capacity factor for oil-fired units, the annual increase in O&M cost results in an approximate increase of $7.10/MWhr in the average cost of generation.

Discussion of Cost Impacts

It is estimated that the cost associated with compliance with the proposed multi-pollutant regulation would result in a cost increase of approximately $15 to $16 per MWh (or $0.015 to $0.016 per kWh). Note that this is not an increase in electric rates, but rather an increase in generation costs for the affected units. The Department does not believe their will be an increase in electric rates, as discussed below. To put this generation cost increase into perspective, it may be compared to the average cost of energy on the PJM grid, which is the regional electrical grid that encompasses all of the units subject to the proposed regulation. In order to keep consumer electric prices low, the PJM uses locational market pricing (LMP) to establish the price of generation in given areas in PJM based on the generation and transmission resources in that area. Therefore, the price of electricity in PJM can vary from location to location. For 2005, the annual average LMP in PJM was $58.08/MWh, with an annual median price of $47.18/MWh. The annual average LMP for 2005 for the area served by the units subject to this proposed regulation was approximately $5/MWh higher than the PJM average.

It should also be noted that while the average LMP is indicative of power cost over the long term, it does not provide any indication of the volatility of the market and the effects of the various market forces. For example, in 2001, the PJM real time market annual average hourly price was $37.00/MWh. During this same year, the peak hourly cost was $1,024/MWh. While the peaks are usually only experienced for a few hours per year,

and the magnitude varies from year to year, this illustrates the volatility and variability of the market in the PJM region.

Operating subject to LMP may lead to the conclusion that the units subject to this proposed regulation would be expected to be operated less, or at a lower capacity factor, as their costs increase relative to the other units in the PJM (up until the point that transmission or other congestion issues increase the LMP in the immediate area). In recent years, coal-fired units have increasingly become the marginal, cost setting units. But coal-fired units in neighboring states are also going to be subject to NO_X, SO_2, and mercury emission reduction requirements from state and/or federal programs. For example, in Maryland, 13 of 14 units covered under the proposed Clean Power Regulations either have installed or are expected to install SCR for NO_X control, and 10 of 14 are expected to install FGD. Forty percent of the steam turbine generator capacity in the eastern PJM region is 40 years old or older, so retrofit difficulties due to age will not be experienced solely by Delaware units. It is anticipated that emission control retrofits at coal units in other states in PJM will tend to reduce the operating impact of the proposed regulation on Delaware's generating units, but it impossible to predict the absolute impact.

Likewise it is impossible to predict the impact on the absolute cost of power due to the impact of this proposed regulation. As coal units have increasing become marginal units in setting the LMP, it would be expected that power costs will increase due to state and federal programs that require more stringent emission controls on existing coal-fired units in the region. Deregulation also provides a strong variable that is difficult to predict.

The impact on LMP in any given area, on the average, may not be greatly affected by local generation depending upon load condition, transmission constraints, etc. In 2003, generation from all of the generating sources in Delaware (not just the units subject to this proposed regulation) provided less than 60% of the electricity consumed in Delaware. And while supplying the 60% of the load in 2003, Delaware's generating units collectively averaged only a 27% annual capacity factor, based on heat input ratings. Further, during the same time frame, the units subject to the proposed multi-pollutant regulation collectively averaged only a 37% annual capacity factor, based on heat input rating.

Power supplied to any given location may be from, or partially from, local generating units, contracted power from other wholesale market participants, and purchases from the wholesale market administered by PJM. Under these conditions, the power cost at any given time will be a function of the least cost power resources available to meet the demand in the local region. This situation also provides additional flexibility for the units subject to this regulation to select times of operation and increase loads when the demand for power rises and the electricity prices are higher.

With regards to the cost estimates discussed in this section, some industry sources indicate that there may be a number of opportunities to reduce the cost of compliance with the emissions limitations provided in the proposed multi-pollutant regulation. While

the economics are always going to be unit/site specific and subject to the variability of an owner/operator's compliance strategy, the information suggests that there may be less costly alternatives for some units. Some of these lower-cost compliance opportunities include the following:

- The literature suggests there is significant mercury removal co-benefit from the installation of SCR for mercury control and FGD for SO_2 control. This suggests that for units installing SCR and FGD, the capital cost of mercury-specific control technology may be reduced due to a reduced need to remove mercury separately. This would also tend to reduced the O&M cost due to less equipment to operate and maintain as well as reduced consumption of chemicals and reagents.

- The literature suggests that for some units it may be possible to attain NO_X reductions at the same levels as SCR by using layered NO_X removal technologies that collectively are less expensive than SCR. The literature suggests that the use of modern low-NOx burners, over-fire air, and selective non-catalytic reduction (SNCR) on smaller coal fired units may be as effective as, and less costly than, SCR for those units.

- Literature suggests that a hybrid SNCR/SCR may provide somewhat reduced capital costs compared to a full scale SCR system while providing improved reagent utilization and NO_X removal efficiency relative to SNCR. A hybrid system may be composed of a reagent injection system, virtually identical to SNCR, and a small SCR catalyst installed in the ductwork. The SNCR sub-system reduces NO_X and is operated with an ammonia slip to facilitate the further NO_X reduction in the presence of the catalyst. The smaller required size for the SCR in such a hybrid scenario would facilitate installation at a site with limited footprint or structural obstructions.

- The literature suggests that depending upon fuel sulfur content, duct injection may provide sufficient SO_2 removal to meet required levels. The literature also suggests that duct injection may also provide an additional NO_X and mercury reduction benefit. Some literature also suggests that the use of certain SO_2 reducing reagents, such as Trona, offer significant (up to 80%) SO_2 reduction capability and may also enhance the performance of particulate removing electrostatic precipitators. Duct injection represents a potential significant capital cost savings relative to FGDs. The reduction is area required for duct injection relative to a full wet scrubber installation would facilitate SO_2 reduction at a facility of limited footprint.

- The literature suggests that depending upon fuel sulfur content, dry scrubbers (or spray dry scrubbers) may provide sufficient SO_2 removal to meet the limits of the proposed multi-pollutant regulation. Dry scrubbers offer significant capital cost savings over comparably sized wet scrubbers, and may be easier to retrofit on units with limited footprint. The literature suggests that the increased cost of reagent consumption associated with dry scrubbers may be offset by higher maintenance costs associated with a more complex wet scrubber. Depending upon design, a dry

scrubber may require less area than a wet scrubber, facilitating SO2 reduction at a facility with limited footprint.

- Recent technologies such as Powerspan's Electro-Catalytic Oxidation (ECO) have been proven in bench scale and also pilot scale demonstration projects. The Powerspan ECO technology has been estimated for a 500 MW plant to reduce capital and operating costs by one third relative to the combined cost of separate systems to control NO_X, SO_2 and mercury. The estimate indicated that the cost reduction was in the order of a $60 million capital cost reduction and $5 million O&M cost reduction. The ECO system was reported to reduce SO_2 by 98%, NO_X by 90%, and mercury by 80% to 90%. Fine particulate matter emissions were also reduced by 95%.

- It may be possible at multi-unit facilities to share some of the emission control auxiliary equipment (for example, chemical and reagent preparation and storage equipment) and produce some capital cost savings and a reduction in overall area requirements.

- Facilities have the flexibility to develop more cost effective compliance techniques applicable to that facility, including fuel-switching, operational changes, alternative emission reduction technologies, etc.

References:

Documentation Summary for EPA Base Case 2004 (V.2.1.9) Using the Integrated Planning Model*, US EPA, EPA 430/R-04-008, October 2004,* *http://www.epa.gov/airmarkets/epa-ipm/basecase2004.pdf*

Standalone Documentation for EPA Base Case 2004 (V.2.1.9) Using the Integrated Planning Model*, US EPA, EPA 430-R-05-011, September 2005,* *http://www.epa.gov/airmarkets/epa-ipm/bc1intro.pdf*

Performance and Cost of Mercury and Multipollutant Emission Control Technology Applications on Electric Utility Boilers*, US EPA, EPA-600/R-03-110, October 2003,* *http://www.epa.gov/appcdwww/aptb/EPA600R03110.pdf*

Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options*, STAPPA/ALAPCO, March 2006,* *http://www.4cleanair.org/PM25Menu-Final.pdf*

Electricity Prices in PJM: A Comparison of Wholesale Power Costs in the PJM Market to Indexed Generation Service Costs*, prepared by Synapse Energy Economics for the PJM Interconnection, LLC, June 3, 2004,* *http://www.pjm.com/documents/downloads/reports/synapse-report-pjm-electricity-prices.pdf*

State of the Market Report 2005, *Baltimore, MD presentation by Joseph Bowring, PJM, March 15, 2006, http://www.pjm.com/markets/market-monitor/downloads/mmu-presentations/som-mrc-overview.pdf*

Comments on Delaware Multi-Pollutant Regulation Development, *on behalf of the Center for Energy & Economic Development, Tom Hewson, Energy Ventures Analysis Inc., May 23, 2006, http://www.awm.delaware.gov/NR/rdonlyres/3B571C5A-080A-43D7-A3F2-032AE9748BD7/712/CommentsonDelawareMultiPollutantRegulationDevelopm.pdf*

Technical Support Document for Proposed COMAR 26.11.27, Clean Power Regulations, *Maryland Department of the Environment, April 26, 2006, http://www.mde.state.md.us/assets/document/air/FINAL_TSD_Document.pdf*

State Electricity Profiles 2003, *Energy Information Administration, DOE/EIA-0629(2003), April 2006, http://tonto.eia.doe.gov/ftproot/electricity/stateprofiles/03st_profiles/062903.pdf#search='State%20Electricity%20Profiles%202003'*

Testimony of Frank Alix before the House Subcommittee on Energy and air Quality; Hearing on "Future Options for Generation of Electricity from Coal," June 24, 2003; *Powerspan, www.powerspan.com/news/Testimony062403.shtml*

Trona Injection Tests Mirant Potomac River Station Unit 1, November 12 to December 23, 2005, Summary Report, *Mirant Corporation, January 17, 2006, http://ci.alexandria.va.us/tes/eq/test_summary.pdf#search='Trona%20Injection%20Tests%20Mirant%20Potomac%20River%20Station%20Unit%201%2C%20November%2012%20to%20December%2023%2C%202005%2C%20Summary%20Report'*

Rochester Public Utilities Emissions Control Feasibility Study, Silver Lake Power Plant, Utility Engineering Co, *March 2005, Rev. 4, http://www.rpu.org/pdfs/32305_%20AQCS_Study_%20FINAL.pdf*

Clean Coal Technology, Volume 2, ***Clean Coal Technology Programs: Completed Projects 2003***, *USDOE, December 200, link to document availability at, http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=20455646*

System Overview: ECO Technology (Electro-Catalytic Oxidation), *Powerspan, http://www.powerspan.com/technology/scrubber_overview.shtml*

An overview of Technologies For Reduction Of Oxides Of Nitrogen From Combustion Furnaces, *Bell & Buckingham, MPR Associates Inc., http://www.mpr.com/pdf_files/nox_control.pdf#search='An%20overview%20of%20technologies%20for%20reduction%20of%20oxides%20of%20nitrogen%20from'*

Full Scale Evaluation of a Multi-Pollutant Reduction Technology: SO2, Hg, and NOx, *Mobotec USA Inc., Paper #117,*

http://www.mobotecusa.com/white_papers/Sorbent%20report%20-%20Mega%20symposium%202003%20final.pdf

***Successful SO3 Mitigation While Enhancing ESP Operation at AEP's Gavin Plant by Dry Injection of Trona**, Ritzenthaler & Maziuk, Presented at Power-Gen International, December 1, 2004,*
http://www.solvaychemicals.us/pdf/Trona_Products/PowerGen.pdf#search='Successful%20SO3%20Mitigation%20While%20Enhancing'

***Analysis of Strategies for Reducing Multiple Emissions from Electric Power Plants with Advanced Technology Scenarios**, EIA, SR/OIAF/2001-05, October 2001,*
http://tonto.eia.doe.gov/FTPROOT/service/sroiaf(2001)05.pdf

***Analysis of Strategies for Reducing Multiple Emissions from Electric Power Plants: Sulfur Dioxide, Nitrogen Oxides, Carbon Dioxide, and Mercury and a Renewable Portfolio Standard**, EIA, SR/OIAF/2001-03, July 2001,*
http://tonto.eia.doe.gov/FTPROOT/service/oiaf2001-03.pdf

***Analysis in Support of the Clean Air Interstate Rule Using the Integrated Planing Model**, USEPA, May 28, 2004, http://www.epa.gov/CAIR/pdfs/tsd.pdf*
Access to the EPA's Acid Rain Database can be gained at:
http://www.epa.gov/airmarkets/emissions/prelimarp/index.html

***DNREC Presentation City of Dover McKee Run Unit 3**, 3/9/06,*
http://www.dnrec.state.de.us/air/aqm_page/documents/DoverDNRECPresentation3-9-06.pdf

***Multi-Pollutant Regulation Development Edge Moor Power Plant Regulatory Stakeholders Meeting**, March 9, 2006,*
http://www.dnrec.state.de.us/air/aqm_page/documents/ConectivmultipollutantDNRECPRESENTATIONwebsite.pdf

***Indian River Generating Station Emissions Reduction Presentation DNREC-Rulemaking Process**, March 9, 2006,*
http://www.dnrec.state.de.us/air/aqm_page/documents/DNRECRulemakingMeeting030906Final.pdf

*Memorandum, **Cost-Effective Nitrogen Oxides (NOx) Reasonably Available Control Technology (RACT)**, From D. Kent Berry, Acting Director Air Quality Management Division, US EPA, March 16, 1994,*
http://www.epa.gov/ttn/oarpg/t1/memoranda/costcon.pdf

***Cost Effective Comparisons**, Cost Effective Comparisons for Various CMAQ-Eligible Emissions Reduction Programs, Diesel Technology Forum,*
http://www.dieselforum.org/retrofit-tool-kit-homepage/cost-effectiveness-comparisons/

Integrated Design and Construction for Cost Effective SCR Projects, *RAKuchner and JAHines, Babcock & Wilcox Company, Presented at Power-Gen International 2002, December 10-12, 2002, http://www.babcock.com/pgg/tt/pdf/BR-1733.pdf*

SOx-NOx-Rox Box Technology Review and Global Commercial Opportunities, *Matinelli et al, Babcock & Wilcox, presented at the 4th Annual Clean Coal Technology Conference, September 5-8, 1995, http://www.babcock.com/pgg/tt/pdf/BR-1595.pdf*

Table 26. Average Flue Gas Desulfurization Costs at U.S. Electric Utilities by Census Division and State, *1996 Through 2000, EIA/DOE, http://www.eia.doe.gov/cneaf/electricity/epav2/html_tables/epav2t26p1.html*

Trona Injection Above 70 degF to Remove Sulfur Oxides from Flue Gas, *John Maziuk, Solvay Chemicals, March 10, 2005, http://216.109.125.130/search/cache?p=Trona+Injection+Above+700&prssweb=Search&ei=UTF-8&fr=yfp-t-500&x=wrt&u=www.solvaychemicals.us/pdf/Trona_Products/Trona_Injection.pdf&w=trona+injection+above+700&d=Idm4UyQ8NSS9&icp=1&.intl=us*

Memorandum, ***Economic & Energy Analysis for the Proposed Interstate Air Quality Rulemaking***, *US EPA, January 28, 2004, http://www.epa.gov/air/interstateairquality/pdfs/tm0009.pdf*

Emission Control Installation Timing

Earlier in this document it was stated that the mass emissions limitations established by the proposed multi-pollutant regulation were based on application of the proven abilities of SCR for NO_X control, FDG for SO_2 control, and carbon injection for mercury removal. Successful completion of such pollution control technology projects require time for engineering, design, material procurement, installation, tie-in, personnel training, startup and optimization. There has been some discussion concerning the time required to complete SCR and FGD retrofit projects.

The US EPA performed an investigation to verify that sufficient skilled labor would be available to support the installation of SCR and FGD retrofits required under the CAIR. For SCR, the EPA estimated 22 months would be required for the planning, engineering, procurement, installation, tie-in, start-up and testing for a single unit SCR. At a multi-unit facility, the EPA estimated that the installation for each subsequent SCR (up to four total) could be completed at additional 3-month intervals.

The EPA's investigation also lead to the estimate that FGD installation projects would conservatively require 28 months for the planning, engineering, procurement, installation, tie-in, start-up and optimization testing for a single unit FGD. At multi-unit facilities, the EPA estimated that the installation for each subsequent FGD could be completed at additional 3-month intervals. Information supplied by the Institute for Clean Air Companies (ICAC) in response to an information request provided examples of FGD installation times that tend to confirm the EPA estimates.

In a statement dated April 2002, the Institute of Clean Air Companies indicated that recent experience shows that FGD retrofit systems can be installed in as little as 24 months from the time of contract award to start-up of the FGD system.

In a presentation at a Pennsylvania Mercury Rule Workgroup Meeting on November 18, 2005, the Institute of Clean Air Companies discussed the mercury reduction co-benefit associated with installation of wet flue gas desulfurization (FGD) scrubbers. In this presentation it was indicated that it was taking 19 to 30 months to construct FGD's, with the average being in the mid-20's range. In the same presentation, it was noted the NOx reduction SCR were being constructed in a range of 13 months to 24 months, with the average in the low 20's.

In a March 29, 2004 press release from the Institute of Clean Air Companies (a national trade organization of air pollution control and monitoring supply companies), it was stated that there were sufficient resources to support the implementation of the Interstate Air Quality Rule (IAQR). The IAQR was the name of the earlier version of the program that has since become the Clean Air Interstate Rule (CAIR). The press release further indicates that not only can the emission control industry (including boilermakers) support full implementation of the program by the 2015 deadline, but that the emission control industry could support complete installation by 2010 if necessary. ICAC also published a

report (IAQR Projected 2015 Control Technologies can be Installed by 2010) to document the details of the analysis and justify the conclusions.

A Babcock & Wilcox document discussed significant experience with retrofit SCR installation at facilities with little space and difficult configurations. The document also discusses a project to retrofit a SCR on a 675 MW coal-fired unit that was completed and functioning at 90% NO_X removal efficiency in less than a year from the time the project was awarded.

An emissions reduction project for a Minnesota power plant included the design and construction of two trains of FGD's (spray dry scrubber) to support two small generating units, one rated at 25MW and the second at 61 MW for a total of 86 MW. This project included installation of SNCR with low-NO_X burners and separated over fire air (SOFA) system for NO_X reduction, carbon injection with fabric filters installation for mercury reduction, and significant related plant modifications (such as converting from forced draft to balance draft boiler configuration) for each of the units as well as the FGD installation. The project schedule, for the first unit, showed project completion (including start-up and optimization testing) at 29 months after initiation of permitting activities, and 25 months after initiation of engineering. The project schedule for the second unit showed completion in 34 months after initiation of permitting and 30 months after start of engineering.

Reliant Energy recently announced that it would begin projects to install FGD scrubbers at its Cheswick Generating Station and its jointly-owned Keystone Generating Station. The announcement indicated that the installation on the scrubber at the 580 MW Cheswick Generating Station would begin in the first quarter of 2007 and be in commercial operation by the fourth quarter of 2009. This project schedule appears to be in line with the EPA's FGD scrubber project timeline estimation for large coal-fired power plants

Relative to SCR and FGD, mercury control carbon injection systems are small and would be expected to have less impact on an existing facility for installation. The EPA has estimated that the project duration for carbon injection technology would be less than 15 months. The time frame for tie-in/installation for retrofit is also expected to have less impact than that of an SCR or FGD retrofit project.

References:

Feasibility of Installing Pollution Controls to Meet Phase I Requirements of Various Multi-Pollutant Legislative Proposals*, US EPA, October 2005, http://www.epa.gov/airmarkets/mp/pssupport/feasibility.pdf*

Boilermaker Labor Analysis and Installation Timing*, US EPA, EPA Docket No. OAR-2003-0053, March 2005, http://www.epa.gov/interstateairquality/pdfs/finaltech05.pdf*

Engineering and Economic Factors Affecting The Installation Of Control Technologies For Multipollutant Strategies, *US EPA, EPA-600/R-02/073, October 2002, http://www.epa.gov/air/clearskies/pdfs/multi102902.pdf*

ICAC Says There Are Adequate Resources To Achieve – And Exceed – Proposed EPA Air Regulatory Action, *Press Release from Institute of Clean Air Companies, March 29, 2004, Supporting ICAC report* ***IAQR Projected 2015 Control Technologies can be Installed by 2010****, at http://www.icac.com/files/public/IAQRboilermaker.pdf*

News release, ***Reliant Energy to Install State-Of-The-Art Pollution Controls at the Cheswick Generating Station****, July 5, 2006*
www.redorbit.com/modules/news/tools.php?tool=print&id=560089

Rochester Public Utilities Emissions Control Feasibility Study, Silver Lake Power Plant, Utility Engineering Co*, March 2005, Rev. 4,*
http://www.rpu.org/pdfs/32305_%20AQCS_Study_%20FINAL.pdf

Recent SCR Retrofit Experience on Coal-Fired Boilers*, Nischt et al, Babcock & Wilcon, 1999,*
http://www.babcock.com/pgg/tt/pdf/BR-1694.pdf#search='Babcock%20and%20Wilcox%20SCR%20retrofit'

The Babcock & Wilcox Company Awarded Scrubber Contract For Allegheny Energy*, B&W News, July 14, 2006, http://www.babcock.com/pgg/pr/alleghenyhatfield.html*

Babcock & Wilcox announcement, ***SCR Retrofit on a 675 MW Coal-Fired Boiler Achieves 90% NOx Reduction, Turnkey project completed in less than ten months****, 2000, http://www.babcock.com/pgg/ps/sb-016.pdf#search='SCR%20Retrofit%20on%20a%20675%20MW%20coalfired%20boiler'*

There is adequate labor, time, and vendor capacity to retrofit compliance technology for a multi-pollutant bill because:, *Statement from the Institute of Clean Air Companies (ICAC), dated April 2002,*
http://www.icac.com/files/public/labor.pdf#search='there%20is%20adequate%20labor%2C%20time%2C%20and%20vendor%20capacity'

Availability of Mercury Control Technology*, Presentation to Pennsylvania Mercury Rule Workgroup Meeting, by David Foerter, Institute of Clean Air Companies, November 18, 2005,*
http://www.dep.state.pa.us/dep/DEPUTATE/AIRWASTE/AQ/regs/docs/Foerter_Presentation_111805.pdf#search=%22coal%20scr%20months%22

Integrated Design and Construction for Cost Effective SCR Projects*, RAKuchner and JAHines, Babcock & Wilcox Company, Presented at Power-Gen International 2002, December 10-12, 2002, http://www.babcock.com/pgg/tt/pdf/BR-1733.pdf*

ICAC E-mail Response to Information Request, Carolyn Slaughter (ICAC) to Robert Clausen (DNREC), dated September 12, 2006

Benefits Of Emissions Reductions Associated With This Proposed Regulation

A wide range of human health and welfare benefits are associated with reductions in NO_X, SO_2, and mercury emissions from power plants. The Department, in its technical and professional opinion, believes that this regulation will be instrumental in achieving attainment with national ambient air quality standards of ozone and particulate matter, and reducing mercury emissions in the state of Delaware, which will result in benefits to the state of Delaware, including the following:

- Reduction in the incidence of premature mortality.
- Reduction in the incidence of non-fatal myocardial infarction.
- Reduction in the incidence of chronic bronchitis.
- Reduction in the incidence of hospital admissions for respiratory and cardiovascular problems.
- Reduction in the incidence of emergency room visit for asthma.
- Reduction in the incidence of respiratory symptoms.
- Reduction in the incidence of lost work days.
- Reduction in the incidence of school absences.
- Reduction in IQ loss (neurobehavioral incidence reduction) in fish-consuming population.
- Improvement in visibility
- Improvement in yield for agronomic crops.
- Reduction of injury to forest trees, foliage, and ornamental plants
- Reduction in impact on the health and stability of ecosystems.

In its CAIR analysis, US EPA grouped New Jersey and Delaware together for analysis purposes. The US EPA estimated that approximately $630 million of the total annual CAIR program benefit could be attributable to annual SO_2 and NO_X controls for New Jersey and Delaware in Phase I of the CAIR program, and approximately $1.1 billion of the total annual benefit could be attributed to annual SO_2 and NO_X controls for New Jersey and Delaware in Phase II of the CAIR program. The US EPA based estimated CAIR benefits on population, and indicated that CAIR benefits in a state could be estimated based on the population of that state. The US Census Bureau's estimated 2005 population for Delaware is approximately 9% of the combined New Jersey/Delaware population. It is estimated that Delaware would realize an approximate $57 million annual benefit in Phase I of CAIR and an approximate $99 million annual benefit in Phase II of CAIR.

Since the proposed multi-pollutant regulation's annual SO_2 mass emissions cap is similar to (less than 6% lower) the CAIR Phase II cap for the affected units, and the proposed regulation's annual NO_x cap is higher than the CAIR Phase II cap (effectively establishing the CAIR program as the controlling factor), it is estimated that the annual benefit from the proposed multi-pollutant regulation would be similar to that estimated

for Phase II of CAIR. However, other states may not be implementing their emissions reductions at the same pace set in Delaware, resulting in pollutants transported into Delaware being between CAIR Phase I and CAIR Phase II levels until the regulatory start of the CAIR Phase II. Therefore, it would be expected that Delaware would realize an annual benefit between the estimated Phase I $57 million and the estimated Phase II $99 million during the CAIR Phase I period. After the regulatory start of the CAIR Phase II, it would be expected that Delaware would realize the Phase II annual benefit estimated at $99 million.

The NO_X reductions anticipated to result from implementation of the proposed regulation are expected to assist Delaware in obtaining the required emissions reductions necessary to meet Delaware's Clean Air Act obligations for Reasonable Further Progress for the 8-hour ozone standard.

An additional benefit of the proposed regulation is that the emissions reductions required in the regulation will help Delaware achieve attainment of the ground level ozone and fine particulate national ambient air quality standards (NAAQS). This may be of significant economic benefit to Delaware as it would make Delaware more attractive to businesses considering moving into Delaware. This is because for areas classified as non-attainment, any new emissions source of the non-attainment pollutant would be required to offset their emissions so that the new source does not add to the non-attainment problem. Along with this is the stigma that for non-attainment counties, the air is not healthy to breathe for the employees of any company considering location in those Delaware counties.

The EPA estimated that the CAMR would result in an approximate 3% to 4% reduction in fish tissue mercury concentration alone, and when combined with the PM reduction effects of CAIR, the total fish tissue mercury concentration was estimated to be reduced by approximately 19% to approximately 22%. The EPA also estimated an approximate $11,000 annual benefit with CAIR and CAMR due to avoided lost earnings associated with IQ loss due to mercury exposure. As the proposed multi-pollutant regulation closely follows the mercury emission caps associated with CAMR, it is estimated that the proposed regulation will result in similar benefits.

Because mercury has been shown to be a bioaccumulative toxic metal, and recent studies have demonstrated that local controls of mercury emissions lead to reduced levels of mercury concentration in local ecosystems, it is appropriate to apply controls to large mercury emitting sources. However, the Department was not able to obtain sources of information that quantify the economic impact of mercury emissions reductions on neurological effects, cardiovascular effects, genotoxic effects, immunotoxic effects, or ecological effects. Therefore, while it is evident that economic benefits will accrue, for the purpose of quantifying economic benefits, no benefits were estimated for mercury reduction.

In the CAIR analysis, the US EPA indicated that the combined New Jersey and Delaware emissions contributed to $PM_{2.5}$ non-attainment in downwind areas in 13 states and the

District of Columbia. Emissions reductions occurring in Delaware would reduce Delaware's contribution to $PM_{2.5}$ non-attainment in those areas.

The US EPA's CAIR analysis also indicated that Delaware sources contribute to 8-hour ozone standard non-attainment in 13 areas in 3 downwind states. Emissions reductions occurring in Delaware would reduce Delaware's contribution 8-hour ozone standard non-attainment in those areas.

***References**:*

***Inclusion of Delaware and New Jersey in the Clean Air Interstate Rule**, 40 CFR Parts 51 and 96, Federal Register Vol. 71, No. 82, Friday April 28, 2006, http://a257.g.akamaitech.net/7/257/2422/01jan20061800/edocket.access.gpo.gov/2006/pdf/06-2750.pdf*

***Regulatory Impact Analysis for the Final Clean Air Interstate Rule,** US EPA, EPA-452/R-05-002, March 2005, http://www.epa.gov/cair/pdfs/finaltech08.pdf*

***Regulatory Impact Analysis of the Final Clean Air Mercury Rule**, US EPA, EPA-452/R-05-003, March 2005, http://www.epa.gov/ttn/ecas/regdata/RIAs/mercury_ria_final.pdf*

***Technical Support Document for the Final Clean Air Interstate Rule, Air Quality Modeling**, US EPA, March 2005, http://www.epa.gov/cair/pdfs/finaltech02.pdf*

U.S. Census Bureau, State & County Quick Facts, http://quickfacts.census.gov/qfd/